

## Place Assimilation in Arabic

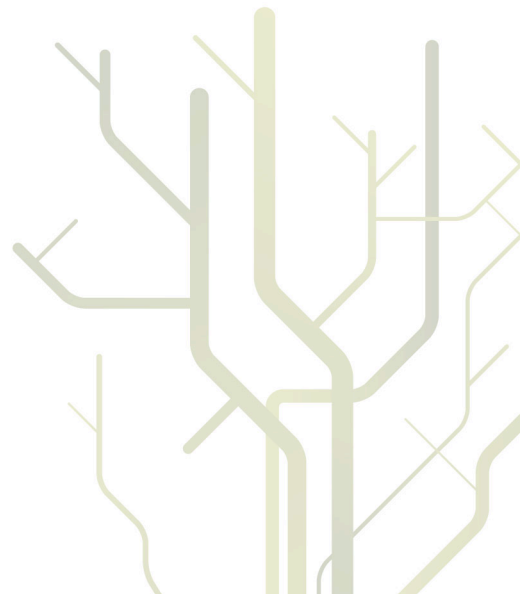
### Contrasts, Features, and Constraints



**Islam Youssef**

A dissertation for the degree of  
Philosophiae Doctor

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# PLACE ASSIMILATION IN ARABIC

CONTRASTS, FEATURES, AND CONSTRAINTS

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A dissertation submitted for the degree of Philosophiæ Doctor

University of Tromsø  
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## Abbreviations and symbols

[ ]	boundaries of phonetic form
/ /	boundaries of surface representation
// //	boundaries of underlying representation
√	consonantal root
>>	dominates
∅	empty feature
∅	empty <i>or</i> unspecified segment
!	fatal violation
✓	feature specification
~	in free variation with
→	leads to
μ	mora
-	morpheme boundary
< >	morphological paradigm
☞	optimal candidate
{ }	optional <i>or</i> unordered
'	primary stress
ω	prosodic word
σ	syllable node
*	violated <i>or</i> unattested
#	word final
1	first person
2	second person
3	third person
ADJ	adjective
BA	Baghdadi Arabic
C	consonant <i>or</i> consonantal
CA	Cairene Arabic
Cat	category

C <sup>g</sup> C <sup>g</sup>	geminate
cl	closed
c-m	consonantal manner
COLL	collective noun
CON	the constraint set
cor	coronal
c-p	consonantal place
CPA	coronal place assimilation
DEB	Derived Environment Blocking
def	definite article
DEP	dependency constraint
detr	detransitive
dor	dorsal
EFT	Emergent Feature Theory
ES	emphasis spread
EV	epenthetic vowel
EVAL	the Evaluator function
F	feature
F <sub>1</sub>	first formant
F <sub>2</sub>	second formant
FG	Feature Geometry
FPL	feminine plural
FRIC	fricative
FS	feminine singular
G	glide
GEN	the Generator function
Hz	hertz
IPA	International Phonetic Alphabet
L	liquid
lab	labial
<i>l</i> -assimilation	assimilation of the definite article <i>l</i> -
LPA	local place assimilation
L-R	left-to-right
MAX	maximality constraint
MORPH	morpheme
MPL	masculine plural

ms	milliseconds
MS	masculine singular
N	noun
NC	nasal + oral cluster
NCC	No Crossing Condition
N/D	non-derived
neg	negation
NPA	nasal place assimilation
NUC	nucleus
OA	Old Arabic
OCP	Obligatory Contour Principle
op	open
OP	Optimal Paradigms
OT	Optimality Theory
PF	phonetic form
PL	plural
pref	prefix
PSM	Parallel Structures Model
QUAUDRI	quadrilateral root
R-L	right-to-left
SG	singular
SPE	<i>The Sound Pattern of English</i>
SR	surface representation
SV	stem vowel
UFT	Unified Feature Theory
UG	Universal Grammar
UR	underlying representation
V	vowel <i>or</i> vocalic
VOT	Voice Onset Time
v-p	vocalic place
WP	weak palatalization



## Preface

This thesis provides evidence from Cairene and Baghdadi Arabic that sub-segmental representations depend on the patterns of contrast and phonological activity in a given language. I investigate every process of place assimilation in these two varieties, and show that the analysis of an individual phenomenon must be congruent with that of the overall sound system. The key question here is whether or not sound patterns can be considered as manifestations of an innate set of universal features (à la Jakobson, Fant, and Halle 1952, Chomsky and Halle 1968). My answer is negative. Features are assumed to be learned on a language-by-language basis (following Mielke 2008), and only those features that characterize phonologically active classes are available to the language learner (see e.g., Dresher, Piggott, and Rice 1994, Clements 2001). Contrastive features are treated as abstract categories, which are substance-free (Blaho 2008, Iosad 2012a). This stems from the belief that phonology and phonetics are two independent domains, though resembling each other in obvious ways.

The empirical contribution of this thesis is to provide in-depth descriptions of all instances of place assimilation in Cairene and Baghdadi Arabic. The study is based on an extensive amount of data, mainly collected at first hand from native speakers, but also extracted from secondary sources (as indicated in each chapter). These data are presented and carefully examined, uncovering new and interesting facts about the patterns, and also holding implications for the wider context of Arabic dialectology. The processes exhibit wide variation in terms of domain, direction, and locality of application. They may take place between consonants (as in primary place assimilation); between vowels (as in monophthongization); or between a consonant and a vowel (as in pharyngealization and palatalization).

The theoretical contribution of the thesis is two-fold. First, it offers new solutions to a number of representational and computational challenges in the analysis of place assimilation. Second, it offers an exposition and implementation of a comprehensive theory of sub-segmental representation. I will adopt a revised version of the Parallel Structures Model (Morén 2003, 2006, 2007a, *inter alia*), a minimalist and non-innatist approach to feature geometry that applies parallel structures and features to vowels and consonants. The most obvious benefit is a coherent account of C-V interactions. Another benefit is a unified analysis of multiple facts, given that it calls for careful examination of entire sound systems before an understanding of particular phenomena can be reached. In developing a constraint-based analysis of these phenomena, I argue that representations must be reintroduced into the theory of computation.

The thesis is organized as follows. Chapter 1 lays out the theoretical framework and introduces the linguistic varieties under investigation. Chapters 2 through 6 look into the processes of place assimilation in Cairene and Baghdadi Arabic—showing distributional patterns (data), followed by autosegmental representations (features) and optimality-theoretical analysis (constraints). In chapter 2, I provide a detailed account of local place assimilation and address a few relevant issues in autosegmental phonology. In chapter 3, I defend an analysis of emphasis spread that relies on a low vowel phonemic split between emphatic /a/ and plain /a/. In chapter 4, I investigate labialization, viz., contexts in which /i/ and /u/ exist in complementary distribution, and crucially argue that consonantal features can spread to vowels upon assimilation. In chapter 5, I present monophthongization as a case of synchronic reciprocal assimilation that is blocked in well-defined phonological and morphological contexts. In chapter 6, I examine the non-phonological palatalization of coronal and velar stops, and show that palatal consonants in these varieties are specified for a vocalic, but not for a consonantal place feature. Finally in chapter 7, I draw some general conclusions based on the entire feature geometries of the respective varieties.



# CHAPTER 1

## Introduction

The purpose of this introductory chapter is to provide a conceptual and methodological framework for analyzing place assimilations in Arabic. Section 1.1 establishes a division of labor between phonological and phonetic representations, and with that in mind, section 1.2 discusses the composition, origin, and organization of distinctive features. Section 1.3 presents the adopted model of feature geometry: its architecture and basic principles, as well as its role in a constraint-based account. Finally, section 1.4 introduces the two language varieties examined in this dissertation, placing them in their typological and socio-historical contexts.

### 1.1 The Modular Approach

The analysis of place assimilation in this thesis draws heavily on a modular approach to the sound component of grammar, comparable to that of Hale, Kisser, and Reiss (2007). Particularly, the proposed model re-emphasizes the autonomy of phonology from phonetics, and maintains that the elements of phonological computation and representation are domain-specific and only have a loose correspondence to phonetic reality. The view that phonological features are abstract and language-specific is in line with an old-new tradition that goes back to the Contrastive Hypothesis of structuralism, and currently underlies theories of Modified Contrastive Specification (e.g., Dresher, Piggott, and Rice 1994) and Active Feature Specification (Clements 2001). Under this conception of phonology, only synchronic information—viz., contrasts and alternations—are considered, whereas phonetically-driven sound changes are placed outside the domain of grammar.

The division of labor between phonetics and phonology is illustrated in Figure 1. This simplified diagram shows two levels of phonological description, an underlying representation (UR; the form as stored in the speaker's mental lexicon) and a surface representation (SR; the phonological output form), which are rendered into phonetic form (PF; the physical realization of a speech sound). A consequence of this layering is that processes map phonological objects (UR) onto other phonological objects (SR) rather than onto phonetic ones (cf. Harris and Lindsey 1995).

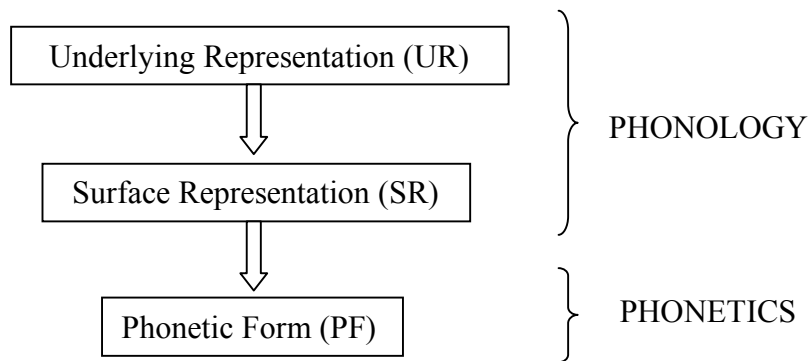


Figure 1. Levels of representation and division of labor between phonetics and phonology

These levels correspond to three types of transcription schemes: UR appears between double slashes // //, SR between single slashes / /, and PF between square brackets [ ] (see also Shahin 2002:51). The distinction between surface and phonetic form is often implicitly assumed in generative phonology, although rarely spelled out in practice. This is important if each module is to possess its own alphabet. On the other hand, it is not the case that UR and SR are necessarily distinct: underlying //m// corresponds to surface /m/ (but it may also correspond to /m/). We will, therefore, assume that UR and SR have the same formal structure: they consist of features, autosegmental tiers, syllables, and so forth (van Oostendorp 2005).

This view is compatible with the idea that phonological distinctive features enjoy autonomy of interpretation, assuming that they are only specified, or present, on the underlying and surface levels. A feature is present underlyingly on a given segment if it is required to distinguish that segment from another—i.e., if it is unpredictable. In addition, a feature is present at the surface phonological level “if it is required for the statement of phonological patterns (phonotactic patterns, alternations, etc...) at that level” (Clements 2001:77). To put it another way, evidence for phonological specification can come only from evidence of lexical or phonological activity. Phonetic representations, on the other hand, are tremendously over-specified, containing information that is not shared by the phonology. Still, this extra information is useful for the pronounceability of the abstract phonological categories. Following Avery and Idsardi (2001), I presume that the mapping from phonology to phonetics translates into a process of *completion*, by which a segment acquires its phonetic content or, in their words, “its missing gestural specifications”.

## 1.2 The Nature of Phonological Features

Distinctive features are the quarks of phonological representation. They are typically regarded as compositional in nature (i.e., the building blocks of segments), and also as cross classifying (i.e., dimensions that characterize “natural” or phonologically active classes of segments). The composition, origin, and organization of these features have occupied phonologists for decades, and a number of comprehensive, yet conflicting, approaches have been proposed. The controversy about distinctive features revolves

around three main questions: (i) whether they are abstract or grounded in phonetic substance; (ii) whether they are innate or simply emergent and learnable; and (iii) whether they are grouped in bundles or organized in some hierarchical structure. This section attends to each of these issues, which can be taken as theoretical points of departure for the model used in this thesis.

### 1.2.1 The Composition of Phonological Features

Jakobson, Fant, and Halle (1952) set the stage for the development of a formal feature theory, later devised in the generative framework in Chomsky and Halle's (1968) seminal work *The Sound Pattern of English* (SPE). Post-SPE, it became standard to assume a purely phonetic (i.e., substance-bound) interpretation of features, with direct mapping to articulatory or acoustic correlates. It was also assumed that segments are fully specified for distinctive and non-distinctive features, which have binary values. These features define inventories and patterns in phonology, characterize only natural classes, and explain markedness (Cohn 2011:16). More recently, this approach relates to the growing body of research on Phonetically-Driven Phonology (e.g., Flemming 1995, Hayes 1997, Kirchner 1997, Boersma 1998, Hayes, Kirchner, and Steriade 2004), which investigates the role of functional factors, including non-contrastive and gradient properties, in determining phonological computation and representation.

On the other end of the spectrum, there is the tradition of abstract, substance-free features. The approach can be traced back to structuralists like Trubetzkoy (1939) and Hjelmslev (1943) who asserted that distinctive features in an inventory must only be established on the basis of the "system of oppositions". That is to say, a feature is distinctive in a phoneme if and only if there is another phoneme in the language that is identical except for that feature. It follows that distinctive features are language-specific, and have no one-to-one correspondence to phonetic interpretation. This view is well represented in generative phonology. One case is Underspecification Theory (e.g., Archangeli 1988, Steriade 1995), according to which all and only unpredictable features are specified in the lexical or underlying representation, whereas predictable non-distinctive features are inserted by redundancy rules in the course of derivation.<sup>1</sup> Another is Modified Contrastive Specification, an inventory-driven approach to specification combined with a theory of markedness, advocated by phonologists of the Toronto School of Contrast (e.g., Dresher, Piggott, and Rice 1994, Avery 1996, Dresher 2003, 2009, Hall 2007). Pursuing this reasoning a step further, the theory of Radical Substance-Free Phonology (see e.g., Blaho 2008, Odden 2010) maintains that phonology is a strictly symbolic computational system that has no access whatsoever to the phonetic content of distinctive features. As a consequence, markedness and typological tendencies are not considered part of phonological competence, but rather as epiphenomenal manifestations of an extra-phonological nature.

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<sup>1</sup> Due to vicious criticism, Underspecification Theory has been largely abandoned at the present time in favor of approaches that disallow the use of redundancy rules (Clements 2001:76).

Integrating insights from various models, my account makes a number of crucial assumptions about the composition of phonological features. First, as discussed in §1.1, I advocate an autonomous view of phonology according to which the units of phonological representation cannot be reduced to explanations that obtain from other extra-linguistic domains (Anderson 1981:506). This modular enterprise resides in a purely phonological (abstract) approach to features à la Trubetzkoy, in a clear rejection of the Jakobsonian/SPE-style features, which can be read off the phonetics. Most importantly, any redundant information is eliminated when assigning distinctive features to segments. But the autonomy of phonology need not dismiss the convention of stating these features in phonetic terms. The fact is that attested phonological classes reflect much of the same categorization as do strictly phonetic ones (*ibid.*), due to constraints imposed by the vocal tract and the human auditory system (Kenstowicz 1994:136). Thus one may argue for an indirect correlation between phonetic factors and phonological systems. And since the articulatorily or acoustically defined feature labels are non-grammatical ingredients, they have a more descriptive than explanatory value. In this sense, I do not embrace a radically substance-free model of phonology in which features have no intrinsic physical interpretation.

Second, I adopt the principle of Representational Economy (Clements 2001), which states that only active features are present in phonological representations. On the lexical level, segments are minimally specified for (unpredictable) features that distinguish them from one another. Unlike Halle (1959), however, I do not assume that segments are fully specified to begin with, but that distinctive features are added once a contrast is established, in line with the main proposal of the Toronto School of Contrast (albeit not in the fashion of the Successive Division Algorithm of Dresher (2003, 2009)). On the post-lexical level, which is roughly equivalent to SR, it is the phonological behavior of segments that determines their featural composition. And segments that pattern together—as in assimilation, neutralization, etc—share features. Distinctive features, then, reflect the classification of segments in a given language, and they are determined by an examination of its system of contrasts and sound patterns, hence the term *contrastive features*. This view is more tenable than full specification, which stipulates the presence of phonological features when there is no independent phonological evidence to support them.

The next assumption follows logically from the first two: feature specifications are relativized to each phonological system. This statement can be interpreted in two ways. One is that the same phonetic element, say, the alveolar trill [r], may have different featural analyses in two languages if it patterns or behaves differently. Another is that features have a consistent phonetic interpretation within a language, but not across languages. And it is acceptable to introduce any feature label, say, [peripheral] or [lowered larynx], should that be needed for some language (see e.g., Rice 2002, Youssef 2010a). In this scenario, it is pointless to compare inventories based on the features they use, that is, without considering how these features are interpreted in their respective phonological systems.

The last premise is feature privativity. Unlike SPE's binary features, privative features cannot express ternary divisions or make (arguably unneeded) distinctions between the absence and the negative value of a feature; and hence they are more economical (Blaho 2008:27–9). They are suitable to the present account since “they restrict possible processes: only a feature can spread; its absence cannot” (ibid.).<sup>2</sup>

### 1.2.2 The Origin of Phonological Features

The next question is: where do these phonological features come from? SPE claims that phonological features are part of Universal Grammar (UG), the innate blueprint of an individual's linguistic competence. A standard assumption in feature theory since the 1960s, including models that subscribe to underspecification, has been that segments are pre-specified for a small, universal set of features which directly map to their phonetic correlates. This set provided a formal tool to capture natural classes of segments and to state phonological rules or constraints. The arguments in favor of an innatist approach to features are often typological (given the overwhelming similarity between attested sound patterns across languages) or acquisitional (having a hard-wired feature set simplifies the learning process) (Iosad 2012a:8). Only recently have researchers begun to question the assumptions and predictions of this “strong UG” approach, showing that it is responsible for most unresolved problems in the formal modeling of phonological processes and inventories.

The latter line of research maintains that innate feature theory duplicates explanations delivered by phonetic similarity and historical/analogical change. Mielke (2008) mounts two arguments against innate universal features. First, they are incapable of characterizing many attested unnatural classes, some of which are more common than typical natural classes. Second, they fail to account for well-documented observations about language-particular patternings of the “same” segment types. The alternative that Mielke proposes is Emergent Feature Theory (EFT), where “features are abstract categories based on generalizations that emerge from phonological patterns”. EFT is consistent with the principle of representational economy (see §1.2.1) since features exist only as needed for a given inventory, and also with an autonomous conception of phonology (§1.1) since features are built on pure phonological considerations. An outcome of prioritizing language-internal evidence in specifying features is that many cross-linguistic generalizations become informative rather than explanatory.

Most pertinent to the present account is the mechanism of feature assignment in EFT. Mielke (2008) contends that phonologically active classes are learned through the application of cognitive powers such as categorization and generalization to the phonological patterns observed in the adult language. In other words, an adult-like grammar can be reached if we stipulate that the child is equipped with “a universal computational system and a set of primitives that can be modified upon exposure to

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<sup>2</sup> Privativity is also central to a number of non-feature-based models. For example, in Element Theory (Harris 1994, Harris and Lindsey 1995), elements are described as “single-valued objects which are either present in a segment or absent from it”.

positive evidence” (Hale and Reiss 2008:176). In fact, a growing body of work on the acquisition of phonology supports such an experiential learning process of phonological classes (see Cohn 2011 and references therein). It follows that features in EFT are abstract categories constructed on the basis of sound patterns rather than being the driving force that predetermines these patterns. While this seems to allow any logical grouping of segments into classes, the patternings that will actually be realized are determined and constrained by the physical properties of the speech sounds among other extra-grammatical factors (Odden 2010:103). Note that this weak correlation is all that exists in EFT between phonological entities, in the form of features, and their phonetic substance.

To summarize, EFT argues, convincingly, that distinctive features are discovered on the basis of actual linguistic experience. Once recognized by speakers of a given language, a phonologically active class (at the lexical or post-lexical levels) becomes a cognitive category, which is then “interpreted as a feature that can be said to have emerged and which learners of a language may acquire” (Mielke 2008:168). Because of this apparently backward correlation between features and phonological patterns, the predictive power of an innate feature theory is lost. In fact we initially rejected the classic assumption that features are hard-wired cognitive entities for which segments are pre-specified. Feature specifications in EFT must be language-specific. Nonetheless, we continue to assume that phonological patterns, the foundations for emergent features, are themselves motivated by external (including universal phonetic) criteria.

### 1.2.3 The Organization of Phonological Features

If segments are the sum of their component features, we must ask ourselves about the types of relations that can hold between these two “phonological primitives”. The representational model developed by Jakobson et al. (1952) and by SPE characterized segments as unordered bundles of fully specified features. Features are divided into categories, but no dependency relations between them are assumed. This view was abandoned with the advent of Autosegmental Phonology in the 1970s (Leben 1973, Goldsmith 1976), where features are treated as autosegments in that they reside on autonomous tiers and behave independently of their respective segments. Further, substantial evidence has been adduced that features are organized in a hierarchical tree structure. This is the common denominator of all models of Feature Geometry (FG; Clements 1985, Sagey 1986, McCarthy 1988, Halle 1995, Halle, Vaux, and Wolfe 2000, inter alia), which make a number of different assumptions about the nature of the hierarchy (for an overview, see Uffmann 2011).

The ultimate goal of FG is to explain recurrent feature groupings. To attain this, features that behave together as a unit are organized under higher-order categories known as *class nodes*. Clements (1985) proposed the familiar labels: Place (which is further subdivided into Labial, Coronal, and Dorsal), Manner, and Laryngeal. These nodes are intended to group features below them, and they lack any featural content themselves. Nevertheless, the vast majority of FG models maintain that class nodes, just like features, can be manipulated by autosegmental operations such as spreading,

delinking, and fusion. Individual features, such as [round], [nasal], [stop], or [voiced], are incorporated into the tree representation as terminal nodes located under their respective organizing nodes. Here we must note that some models (e.g., Sagey 1986, Schein and Steriade 1986, McCarthy 1988) suggest that the so-called major class features—chiefly [consonantal] and [sonorant]—are directly associated with the root node. This is often thought to explain why these features seem to have a special status in sound classifications and why they do not spread and delink like other features.

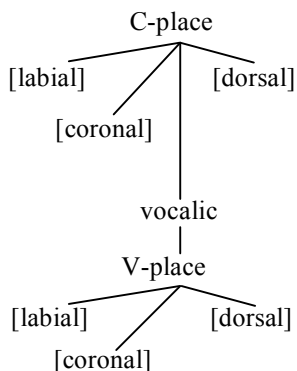
An influential contribution to feature geometry is Unified Features Theory (UFT) developed by Clements and Hume (Clements 1991, Hume 1992, 1996, Clements and Hume 1995). UFT, from which the current FG model draws its inspiration, proposes a unification of place features, such that consonants and vowels utilize the same features, which are linked to two distinct, but hierarchically related nodes. Clements and Hume use the privative oral place features [labial], [coronal], [dorsal], which are by definition more general (i.e., phonetically less definite) than SPE features. On the one hand, these labels are demoted from a class node status in Clements (1985) where they dominate a number of C and V features. On the other hand, they are defined in terms of active articulators (see also Sagey 1986), which allow broader articulatory coverage.<sup>3</sup> A model that requires [labial], [coronal], [dorsal] to do double duty for consonants and vowels dispenses with the traditional vowel features [back], [round], [low] (Clements and Hume 1995), and hence allows for a high degree of economy in the feature system.

How a particular terminal place feature is interpreted in UFT depends on its relationship to a superordinate node in the representational tree. As illustrated in diagram (1a), each of the features [labial], [coronal], [dorsal] can be associated with a C-place node or a V-place node, and the V-place node is dependent on the C-place node (via a “vocalic” node). By unifying consonantal and vocalic place features while at the same time maintaining a degree of segregation between the two, consonants with secondary articulations are easily accounted for. They are represented as branching structures, with primary C-place and secondary V-place features, as in (1b) (van de Weijer 2011: 701). Support for this arrangement comes from the widely attested types of secondary articulation—viz., labialization, palatalization, velarization/pharyngealization—which correspond exactly to the three proposed place features [labial], [coronal], [dorsal] (Clements 1991:98–9). On that account, vowels and consonants with secondary articulation can be grouped into the same natural class. An example is the class of emphasis spread triggers in Cairene, defined by V-place[dorsal], which consists of the pharyngealized consonants /t<sup>ʕ</sup>, d<sup>ʕ</sup>, s<sup>ʕ</sup>, z<sup>ʕ</sup>, r<sup>ʕ</sup>/ and the back vowel /ɑ/ (see §3.2.2.1).

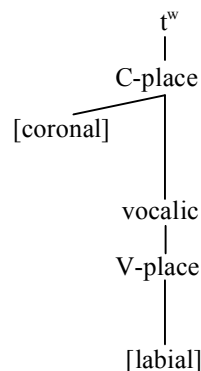
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<sup>3</sup> Specifically, [labial] pertains to the lips; [coronal] to the tongue tip or blade (although etymologically it refers to the crown of the oral cavity, a passive articulator); and [dorsal] to the tongue dorsum (see Ladefoged and Maddieson 1996:43–5).

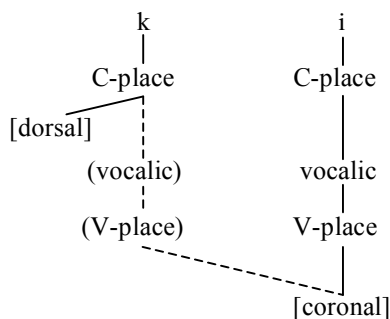
## (1) a. UFT place geometry



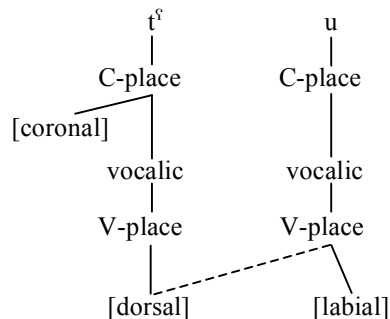
## b. A labialized coronal consonant



The most salient motivation for UFT is to capture place assimilations associated with consonant-vowel interactions (called *cross-category assimilations*; Clements 1991), which earlier feature systems failed to account for. In local V-to-C spreading, a consonant with primary (C-place) articulation takes on a V-place feature of a neighboring vowel, and surfaces with secondary articulation. A typical example is palatalization, illustrated in (2a). Since vowels may only have terminal features under their V-place node (i.e., they do not have C-place features), they never directly impose a primary place shift on consonants (Ní Chiosáin and Padgett 1993). As for C-to-V spreading, a vowel takes on a V-place feature of a neighboring consonant (one with secondary articulation), as in the case of pharyngealization (2b).

(2) a. Palatalization in UFT<sup>4</sup>

## b. Pharyngealization in UFT



Although it is usually claimed that C-V interactions are restricted to vowel place features (Padgett 2011:1781), I argue in §4.3.3 that feature spreading from a C-place node to a V-place node should also be allowed. Given a unified set of place features, all C-to-V and V-to-C effects require no change in feature identity. Consonants and vowels that have the same place feature under different nodes are grouped under one natural class—e.g., coronal consonants with front vowels and labial consonants with rounded vowels (for an outline of empirical evidence, see Clements and Hume 1995: §3.4.3). With these hybrid categories in mind, we are compelled to view phonological

<sup>4</sup> Parenthesized nodes are created by a general interpolation convention.



features as abstract entities that are largely detached from their phonetic content. Moreover, if these feature classes are based on contrast and phonological activity, we should expect that the hierarchy is not universally fixed, but rather allows for some language-particular variation.

Two other predictions emerge from UFT. The first is that long-distance consonant assimilation across vowels is not permitted, whereas vowel-to-vowel assimilation across consonants is. Prohibition of the former type is attributed to the No Crossing Condition (NCC), whereby association lines between the same autosegmental tiers may not cross (Goldsmith 1976). And it is the organizing C-place node in vowels that results in violation of the NCC, in case they are skipped by C-place feature spreading (Clements 1991:108). These types of “consonant harmony” are arguably unattested (see §4.3.3 for some discussion). In vowel harmony, on the other hand, the spreading features are said to be adjacent on the vocalic node (van der Hulst and van de Weijer 1995); hence, the NCC is respected. The model also predicts that processes spreading a vocalic feature may only be blocked by vowels or by consonants with secondary articulation since they have features on the same tier (see Clements 1991:109 ff.). To give an example from this thesis, emphasis spread in Baghdadi is blocked by front vowels and palatal consonants, both characterized by V-place[coronal] (see §3.3.2.2).

The organization of place features in UFT is central to this thesis in that it sets the parameters for all types of place assimilation. In particular, C-V interactions are easily explained in terms of a single set of place features organized under a consonantal and/or a vocalic place node. This symmetry is not surprising, knowing that vowel place and consonant place are acoustically and articulatorily similar (Morén-Duolljá 2011), and so it is sufficient that their shared features refer to phonetically broad categories. UFT is compatible with the view that only active features and nodes are present in phonological representations; i.e., they are language-specific.

### 1.3 The Parallel Structures Model

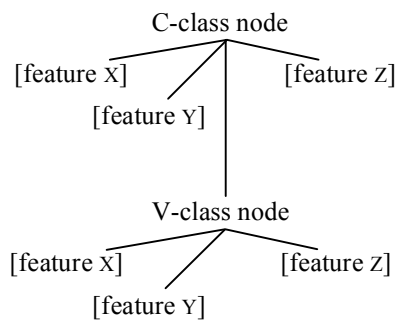
This section introduces the main theoretical-analytical framework that will be used throughout the thesis, the Parallel Structures Model (PSM; Morén 2003, 2006, 2007a, 2007b, Youssef 2006, 2010a, Krämer 2009, Iosad 2012a, 2012b). The PSM is a new restrictive model of feature geometry in which consonants and vowels utilize parallel structures and features whenever possible. Parallelism is expressed by means of a vocalic class node being dependent on a consonantal class node, and identical place, manner, and laryngeal features used at both tiers (expanding on Clements 1991). This not only provides an economical way to represent segment-internal structure, but it also promises to capture all consonant-vowel interactions in a straightforward and unified manner. Restrictiveness is achieved via Feature Economy (Clements 2003), by which feature combinations are maximized within an inventory, and Structural Economy, by which every complex segment implies the presence of a minimally different, less complex segment (in the style of Element Theory). These strategies are further discussed in the subsequent sections.

Features in the Parallel Structures Model meet the assumptions made earlier in this chapter. They are abstract entities in that they are not phonetically determined, and they are specified in the geometry only if there is positive phonological evidence for their existence. In spite of this, the labels for features and nodes in the PSM are still phonetically motivated: “Place” refers to where in the vocal tract the constriction occurs, “Manner” refers to the degree of constriction (or the equivalent for vowels), and terms such as [labial], [coronal], [dorsal], [open], [closed] refer to some broadly defined phonetic properties. The proposed (monovalent) features are assumed to be emergent—that is to say, learned on a language-by-language basis. What is universal in language acquisition are the organizing structures to which children map their learned abstract categories (Morén 2007b:95).

### 1.3.1 Tier Organization

The architecture of the PSM is essentially that of UFT, and is given in (3). This basic skeleton displays two hierarchically organized nodes, one consonantal and another vocalic, and a set of identical terminal features.<sup>5</sup> It applies equally to place, manner, and laryngeal settings, which means that Clements’ (1991) proposal is stretched to its logical limit. In this configuration, consonants can have subsidiary/secondary V-class features and possibly *only* V-class features; whereas vowels cannot have any C-class features—i.e., their C-nodes serve a mere organizational function. By introducing the latter restriction to the model, we cannot dispense with the labels “C” and “V” in favor of some abstract “independent” and “dependent” tiers.

(3) Basic PSM geometry (Morén 2003:262)



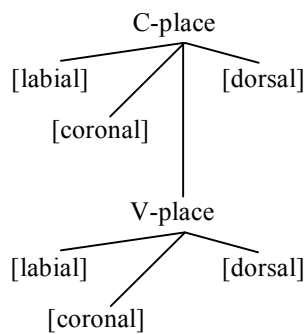
Let us now examine the three basic node types in the PSM. First is the Place tier, the structure of which is shown in (4a). The model incorporates Clements’ (1991) idea that a single set of articulator-based place features—i.e., [labial], [coronal], [dorsal]—correlates with a C-place node and with its daughter V-place node (no intermediate “vocalic” node is assumed). Simple consonants have only one place feature: typically

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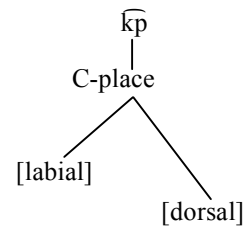
<sup>5</sup> Although node affiliation is an integral part of what a feature is, the PSM assumes that features of the same type under different nodes form a class of a special nature (see §1.2.3). But unlike some versions of UFT, it does not allow the same token feature to simultaneously associate with both a C-class node and a V-class node (Morén 2007a:322). C and V features are seen as separate, though identical, tokens.

under C-place and occasionally under V-place—e.g., all palatals in Cairene and Baghdadi are characterized by V-place[coronal]. Complex consonants have multiple features associated with one place node (as in 4b), while consonants with secondary articulation have features on both the C-place and V-place nodes (cf. (1b)). Vowels have C- and V-place nodes, but only with terminal features on the latter. Following Clements and Hume (1995), rounded vowels are [labial], front vowels are [coronal], and back vowels are [dorsal] (p.276). These structural homologies between C- and V-place are the core device for analyzing most types of place assimilation in this thesis.

## (4) a. PSM place geometry

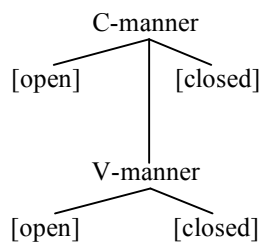


## b. A labial-velar consonant /k̠p/

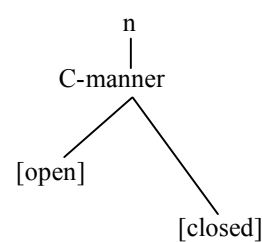


The structure of the Manner tier parallels that of the Place tier. As shown in (5a), a V-manner node is nested in a C-manner node, and both nodes make use of the abstractly defined features [open] and [closed]. This arrangement captures the often overlooked articulatory similarity between consonant constriction and vowel height—the fact that both are based on degrees of constriction (i.e., opening and closing of the vocal tract) and reflect relative sonority (Morén 2003:223). Phonologically, it captures some C-V interactions pertaining to the Manner tier; for example, the correlation between low vowels and pharyngeal consonants in chapter 4.

## (5) a. PSM manner geometry



## b. A nasal sonorant /n/



To characterize the typical manner classes, I suggest that high vowels have V-manner [closed], low vowels have V-manner[open], stops have C-manner[closed], fricatives have C-manner[open], and finally sonorants have C-manner[closed] *and* C-manner [open] (as in 5b). Consonants are distinguished from vowels by their potential to have a C-manner terminal feature. In this way, a large number of features—such as [high], [low], [stop], [continuant], [nasal], [lateral], [approximant], as well as the major class

features [consonantal] and [sonorant]—are eliminated from the grammar and replaced by different combinations of [open] and [closed] across the nodes C-manner and V-manner (Odden 2010:88). Needless to say, these phonetically informed representations are contingent upon overt phonological evidence within a language.

The structure of the Laryngeal tier follows the above pattern, namely, one set of features associated with parallel (related) nodes. Morén (2003) suggests that the same features used for manner specifications can be used for laryngeal specifications. For him, the connection between C- and V- laryngeal features is based on similarities between degrees of glottal constriction and tones (p.229–33). Youssef (2010a), on the other hand, argues for a connection between consonant voicing and vowel height in Buchan Scots, and proposes a common [lowered larynx] feature. The current thesis covers no such correlations, and we will simply use the privative feature [voice] to distinguish lenis from fortis obstruents.

### 1.3.2 Principles of the PSM

Parsimony, a form of Occam’s razor, is the core principle of the PSM from which all others follow. First, representational economy states that no more features should be used than are necessary (given the contrasts directly observable in the language); and hence all redundant features must be omitted. Next, the principle of feature economy (Clements 2003) states that languages tend to maximize the combinatory possibilities of the few available features across their inventories. This can be a useful diagnostic tool to discriminate between competing theories. We may argue, for instance, that Morén’s (2007a) analysis of Hawaiian—in which two C-place features (labial and non-labial) and two C-manner features (open and closed) cross-classify 8 contrastive consonants—is more parsimonious than an analysis within traditional SPE feature theory. Clements notes, however, that no language exploits all workable feature combinations, even if we exclude the functionally unviable ones.

In addition to feature economy, the model observes structural economy, namely that “more complex structures are built from less complex structures”. This principle draws on the molecular (prime-based) approach to segmental representation advocated in Particle Phonology (Schane 1984), Dependency Phonology (Anderson and Ewen 1987), and Element Theory (Harris and Lindsey 1995). It can be formally expressed as follows: for every segment with complex structure, there exist one or more minimally different segments with a subset of this structure. An ensuing assumption is that each active feature in the grammar entails the presence of a simplex segment composed exclusively of that feature, called a “unit segment” (cf. Morén 2006:1209, Youssef 2006:9). The current version of the PSM no longer enforces this as a requirement, although in practice most features would still be represented by these minimal segments so long as there is no phonological evidence to disprove it (see Iosad 2012a: 41). If we establish a link between relative differences in representational complexity and markedness, then segments composed of a single (place or manner) feature are taken to be less marked than other, more complex segments (Morén 2007b: §11). This explains why certain classes of segments are “more basic to inventories than

others” (for example, high and low vowels are cross-linguistically more common than mid vowels) (ibid., p.90).

A final point concerns the autosegmental status of class nodes in the model. As pointed out, class nodes are usually treated as independent entities that can spread and delink, dragging along their dependent features. In this version of the PSM, however, I follow some recent models of feature geometry which do not allow class nodes to operate independently, such as Revised Articulator Theory (Halle 1995, Halle, Vaux, and Wolfe 2000) and, to some extent, Feature Class Theory (Padgett 2002a). Specifically, I propose that under assimilation only individual terminal features spread (to certain non-terminal nodes), *even* when the end autosegmental representation exhibits a shared higher-order node. One reason for adopting this proposal is that nodes are not always activated on the basis of positive phonological evidence, and hence they should not be treated like contrastive features. In many cases, a node is activated simply to host dependent nodes or features that require its presence (Avery and Rice 1989). But one can maintain that representational economy applies to nodes as well as to features (Clements 2001:96). Nodes that have neither contrastive nor organizational motivation in a particular language are assumed to be absent. And nodes that cease to have such a motivation—e.g., via loss of all their dependent features—get to be delinked.<sup>6</sup>

### 1.3.3 PSM-Integrated Computation

In order to account for the assimilation patterns in this thesis, we must activate the proposed autosegmental representations within some computational device. Although a number of theoretical frameworks are suitable for this purpose, I will use a classic version of Optimality Theory (OT; Prince and Smolensky 1993/2004) for three main reasons. First, OT allows for a unified analysis of multiple phonological operations in terms of a single constraint ranking, and as a result, interactions and conflicts between different types of place assimilation can be neatly explained. Second, OT raises some interesting analytical challenges posed to non-derivational models of grammar. These will be addressed in due course and hopefully resolved. Finally is the fact that representations have been largely ignored since the rise of Optimality Theory. The practice has been to conduct cross-linguistic studies of a particular phenomenon and to simply assume convenient features—drawn from a universal set—to characterize it in those languages. The current study, however, offers a constraint-based analysis that incorporates the independently motivated segment-internal structures; and consequently any phenomenon under investigation is situated within the entire sound system of *a* language. But to understand the role these language-specific representations play in the phonological computation, we have to review some original assumptions of OT.

Input-output mappings in OT are determined by two basic functions (see Kager 1999, McCarthy 2002 for a thorough overview). The Generator function (GEN) maps

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<sup>6</sup> The model does allow the existence of nodes with an empty [ϕ] feature, but only if this is required by considerations of contrast (see e.g., §2.3.5).

a single underlying input form into a set of potential output forms called candidates. In principle, GEN has the ability to generate all logically possible output candidates for a given input. This property is referred to as *freedom of analysis*. The degree of “freedom” is a matter of dispute, however. While some OT theorists claim that GEN emits a potentially infinite number of candidates, others embrace a more constrained version of GEN where only representationally well-formed candidates are considered. For the reasons mentioned above, I opt for the interpretation of GEN as restrained by representational primitives and the structures they assume in the geometry (following Uffmann 2007). In our situation, only candidates making use of contrastive, emergent features that are organized in licit PSM configurations (see §1.3.1) are ever generated in an OT tableau. Other structures are universally unavailable, and it is GEN, rather than the constraint ranking, which is responsible to disqualify them (Morén 2007a).

The Evaluator function (EVAL) assesses the candidate outputs provided by GEN and selects the optimal output, the candidate that best satisfies a set of ranked violable constraints CON. Even though candidates are always compared in pairs, in non-serial OT all evaluations take place concurrently and in a one-step mapping from the input to the output. Any OT analysis relies chiefly on the interaction between two types of constraints: markedness and faithfulness. The former evaluates the well-formedness of an output candidate and the latter evaluates the input-output mapping. In order for constraints to have any explanatory value, I argue that they must explicitly refer to representations (Uffmann 2005, 2007). Incorporating PSM feature specifications in the constraint formalism has two main consequences. First, it considerably limits the shape and number of possible constraints in the grammar, and so facilitates the job of EVAL. Second, if features are emergent and language-specific, so too must be feature-encoded constraints. That is to say, constraints operative in a given language are discovered in the process of acquisition via overt, positive evidence from contrasts and alternations (Clements 2001:88, Morén 2007a:335). Other constraints are simply not present. It follows that the universality of CON, a key tenet of classic OT, is no longer assumed. Tragic as this statement may seem, most constraints in CON cannot be fixed across languages “since the representations over which these constraints hold are not comparable in any case” (Iosad 2012a:50).

Alongside the foregoing scholars, I advocate a theory of CON that takes representations into account. In the rest of this section, I will briefly discuss the formalism of some markedness and faithfulness constraints on features and feature combinations that will be used throughout this thesis. Let’s start with faithfulness constraints, which require that an output (surface) form preserve the properties of its basic (input) form. I appeal specifically to Correspondence Theory (McCarthy and Prince 1995), where, in the case of featural faithfulness constraints, correspondence is defined as a relation between two representational entities (such as feature specifications or class nodes). Since features in the PSM are only privative, I do not assume constraints of the IDENT [F] family, but rather MAX [F] and DEP [F]—penalizing feature deletion and insertion, respectively. Not only do MAX and DEP govern features, but they may also govern autosegmental associations in input-output correspondence relationships. Constraints

of the latter type have the instantiations MAXLINK [F] and DEPLINK [F] (cf. Akinlabi 1994, Itô et al. 1995, Morén 1999), and, according to Jurgec's (2010a) formalism in (6a–b), they preserve the associations/links between features and their superordinate class nodes. Two families of faithfulness constraints are utilized to handle opacity effects: Positional Faithfulness (Beckman 1998), formalized in (6c), and Optimal Paradigms (McCarthy 2005a), a type of output-output correspondence.

- (6) a. MAXLINK [F]: Let  $x_i$  be an input root node and  $x_o$  its output correspondent. Assign a violation mark, iff  $x_i$  is associated with the feature [F] and  $x_o$  is not.
- b. DEPLINK [F]: Let  $x_i$  be an input root node and  $x_o$  its output correspondent. Assign a violation mark, iff  $x_o$  is associated with the feature [F] and  $x_i$  is not.
- c. DEPLINK [F]/Y: Let  $x_i$  be an input root node in position Y and  $x_o$  its output correspondent. Assign a violation mark, iff  $x_o$  is associated with the feature [F] and  $x_i$  is not.

Markedness constraints assess the form of an output candidate without regard to the input, favoring certain structural (prosodic, phonotactic, or featural) configurations over others (McCarthy 2002:14). Here, we are concerned with those constraints that make explicit reference to features, the simplest form of which is the \*[F] family.<sup>7</sup> Assuming that phonological computation is economical, constraints against feature co-occurrence are formalized as combinations of more primitive feature markedness constraints of the \*[F] type (Morén 2007a:327). These typically employ the notion of Local Conjunction (Smolensky 1997), defined in (7a) and exemplified in (7b). But according to Morén (2006), constraints against possible feature combinations, such as (7c), would yield roughly the same outcome. To avoid the criticism raised against constraint conjunction (see Padgett 2002b), I will opt for the latter type, namely, complex structure feature co-occurrence constraints.

- (7) a. The local conjunction of  $K_1$  and  $K_2$  in domain D,  $K_1 \& K_2$ , is violated when there is some domain of type D in which both  $K_1$  and  $K_2$  are violated. And the ranking  $K_1 \& K_2 \gg K_1, K_2$  holds.
- b. \*V-place[coronal] & \*V-place[dorsal]: the local conjunction of \*V-place[coronal] and \*V-place[dorsal] is violated when both \*V-place[coronal] and \*V-place[dorsal] are violated by the same segment.
- c. \*V-place[coronal] V-place[dorsal]: a structure with both V-place[coronal] and V-place[dorsal] is prohibited.

<sup>7</sup> Any markedness and faithfulness constraints that refer to higher-order nodes should be viewed as shorthand for a series of constraints that target each individual feature under that node (cf. the final paragraph of §1.3.2).

In the analysis of place assimilations in this thesis, I assume the theory of Generalized Alignment (McCarthy and Prince 1993, see Kager 1999:117–24), formulated in (8), where  $Cat_1$  may denote a feature. Alignment constraints are markedness constraints, and they are usually construed gradiently. To account for assimilation, ALIGNMENT, which enforces the spreading or multiple linking of [F], is generally ranked above DEPLINK [F]. This straightforward interaction between markedness and faithfulness constraints lies at the heart of any OT analysis. Note that the effect of spreading may be overridden or restricted to certain conditions if ALIGNMENT is outranked by a third constraint, such as feature co-occurrence or positional faithfulness (McCarthy 2002: §1.3). Other technicalities of constraint interactions will be explained as they appear in the text.

- (8) ALIGN ( $Cat_1, Edge_1; Cat_2, Edge_2$ ) = *definition*  
 $\forall Cat_1 \exists Cat_2$ , such that  $Edge_1$  of  $Cat_1$  and  $Edge_2$  of  $Cat_2$  coincide (where  $Cat_1$  and  $Cat_2$  are grammatical or prosodic constituents and  $Edge$  is left or right).

#### 1.3.4 Summary

The Parallel Structures Model is a modular, minimalist, emergentist, substance-free, and OT-compatible approach to segmental representation. It is a synthesis of some fairly standard proposals in the phonological literature—all combined into a single overarching theory of feature geometry. Feature specifications in the PSM depend on the contrastive behavior of natural classes of segments within the full phonological system, rather than on the physical nature of the segments themselves. A corollary of this view is that phonological features must be established on a language-by-language basis. That is to say, they are neither innate nor predeterminably universal.

The model offers an effective and economical means of capturing sub-segmental representations. This is achieved first and foremost by a V-class node being dependent on a C-class node, and a single set of (place or manner) features used at both levels (Morén 2003:227). The unification of C and V features not only excludes a slew of features from the grammar, but it also helps to account for numerous parallelisms and interactions in consonant and vowel behaviors. Moreover, PSM architecture is guided by parsimony of features and structures. Feature economy pressures existing features to be reused, and thereby ensures maximum possible feature combinations. Structural economy imposes progressive complexity of structures in a given inventory.

Finally, I argued that an analysis within OT should incorporate feature geometric (PSM) representations into candidate generation and constraint formulation. On one hand, GEN is only able to produce structurally well-formed candidate outputs. On the other, relevant markedness and faithfulness constraints in CON are restricted to valid PSM feature specifications. This is in line with Uffmann's (2007) assertion that some hard universals should remain outside the scope of constraint evaluation.



## 1.4 Arabic Dialects

Modern Arabic vernaculars are presumably descendants of a *koine*, a common ancestor language, which was not based on any one particular geographical area (Ferguson 1959).<sup>8</sup> Whatever the explanation of their development—be it pidginization, substrate effects, the acquisition of Arabic as a second language, or a mixture of all three—it was a long transition by which new “native” varieties, quite different from the *koine*, gradually emerged (Versteegh 1997). Today these varieties vary among themselves to the point of mutual unintelligibility in the extreme cases, and from a pure synchronic perspective, they are full-fledged languages. However, referring to them as dialects of Arabic has validity so long as this is understood to signify their common diachronic origin as well as their social and cultural reality. Arabic dialects are often divided into five major subgroups, roughly based on geographical criteria (*ibid.*, p.145). These are (i) Hijazi (Arabian Peninsula and Yemen); (ii) Mesopotamian (Iraq); (iii) Levantine (Syro-Lebanese); (iv) Egyptian (Egypt and Sudan); and (v) Maghribi (North African). This work surveys the phonological systems of two specific varieties from the second and fourth subdivides, respectively, Baghdadi and Cairene Arabic.

In the general sense, we may call this a study of synchronic microvariation, with the goal being to investigate aspects of phonological variation in the present-day use of these closely related varieties. This has multiple advantages. One is that the overall structures of Cairene and Baghdadi grammars are sufficiently similar to be compared. Moreover, their common origin serves as a natural control, making it easier to detect the micro-parameters of variation. Their similarities and differences are also likely to have consequences in the broader context of Arabic dialectology. That said, one has to remember to treat them as independent linguistic entities if one is to delineate their unique characteristics without the confounding influence of historical, comparative, or other biases.

### 1.4.1 Cairene Arabic

Cairene Arabic (henceforth CA) is the urban dialect spoken by nine million people in the Egyptian capital. It belongs to the Nile delta region of Lower (Northern) Egypt. According to Woidich (1994), modern CA must be conceived as a hybrid dialect that was, more or less, shaped by the massive influx of rural migrants in the second half of the nineteenth century. This wave of migration created an adverse linguistic reaction by which Cairene speakers renounced features from their own speech that they now associate with the low-prestige dialects of the new rural populace (Miller 2004:187). CA is also described as lively and innovative, “manifestly a language in the full vigor of development on all levels, from phonological to syntactic” (Carter 1996:138).

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<sup>8</sup> In reference to this *koine*, the term Old Arabic (OA) will be used generically to denote earlier forms of Arabic (cf. Bellem 2007:54, fn.21). I deliberately avoid the loose and loaded term Classical Arabic. And, where relevant, I use the term (Modern) Standard Arabic to denote the written or literary form of the language. I refer the reader to Owens (2006) for a thorough discussion of these categorizations.

CA is by far the most studied of all Egyptian dialects, and in the literature it is often characterized as a homogeneous variety. However, one cannot help but notice a major split on the basis of social class and/or educational status. So, for the sake of consistency, I will limit the investigation in this study to “Educated Cairene Arabic”, the everyday language of middle-class, educated speakers in Cairo. This is roughly equivalent to Badawi’s (1973) *‘āmmiyyat al-mutanawwirīn* (or Semi-literate Spoken Arabic); and it is to be distinguished from Educated Spoken Arabic, which represents a more formal register than the (colloquial) language of daily communication (Ryding 2006). As a matter of fact, educated speakers command both linguistic systems (with less-than-fluent command of the latter); and because of the reciprocal influence, it is not always feasible to determine which system is being accessed. The researcher must take special care not to conflate the two registers.

While CA is essentially the spoken language of ordinary social intercourse and non-print media (television, radio, film, and theater), it is also increasingly found in written form (Haeri 2003). Prominent examples are: vernacular literature (esp., poetry and drama), advertising, and social media (e.g., wikis, blogs, social networking sites, and online forums). All in all, Cairene is a prestige dialect with influence extending all over the country. It is also widely understood across the Arab World “due to its political and cultural importance” (Kaye 1997:202). The overwhelming presence of Egyptian movies and television soaps is frequently stressed in this connection.

### 1.4.2 Baghdadi Arabic

Muslim Baghdadi Arabic (henceforth BA) is the principal dialect of the Iraqi capital, spoken by about seven million people. BA is classified as a central Mesopotamian dialect of bedouin origin, which was sedentarized at a relatively recent time (Bellem 2007). It is claimed that from the seventeenth century onwards, Baghdad was largely repopulated by immigrants from the rural south and also from north Arabian bedouin tribes, whose dialects are likely the source of present-day BA (Blanc 1964:170). A subsequent influx of rural and bedouin migrants took place in the 18<sup>th</sup>–19<sup>th</sup> centuries. According to Miller (2004:183–4), the dialects of these groups, first demographically then politically dominant, gradually developed into the standard urban dialect of both Sunni and Shiite Muslim communities. As a result of this history, BA is regarded as one of the most conservative Arabic dialects (see §1.4.3).

At this point, it is appropriate to briefly mention Blanc’s (1964) influential study of the communal dialect division in Baghdad, in which he distinguished the Muslim, Christian, and Jewish varieties. Blanc hypothesized that the Muslim variety belongs to the so-called *gilit* group of Mesopotamian Arabic, while the Christian and Jewish varieties belong to the *qiltu* group. (These terms were coined after their reflexes of the Standard Arabic *qultu* ‘I have said’). He maintained that the *qiltu* dialects are a continuation of the medieval Abbasid sedentary vernacular. The *gilit* Muslim dialect is the upshot of a later bedouinization process (see above), which had little or no impact on the speech of the Christians and the Jews in the city (Versteegh 1997:157).

However, since the publication of Blanc (1964), the dialect picture in Baghdad has seen profound changes. First, due to the mass migration of the Jewish community to Israel post-1948, the Jewish dialect has gradually disappeared (Bellem 2007:230). Second, since the old quarters of Baghdad were demographically dominated by one or another religious group, a spontaneous population movement within the city has resulted in considerable dialect leveling (*ibid.*). Finally, the city has witnessed a rapid rate of rural migration from the 1960s, as a result of which BA became established as the prestige local dialect (Abu-Haidar 2006:222). Besides being the majority dialect, it has grown to be the lingua franca of Iraq (*ibid.*), with extensive influence over other dialects. But since BA coexists in a diglossic situation with Modern Standard Arabic, the gap between the two is apparently shrinking (Abu Haidar 1992).

### 1.4.3 The Urban-Bedouin Dichotomy

An important criterion in the classification of Arabic dialects is the urban-bedouin dichotomy (Versteegh 1997:141). The bedouin-type dialects—such as those spoken in southern Iraq (including Baghdad), the desert regions of Jordan and Syria, central and eastern Saudi Arabia, and the Gulf states—are described as conservative in the sense that they preserve more Old Arabic (archaic) features than do the urban dialects of Egypt and the Levant (Holes 1995:57). Versteegh maintains that isolation leads to such conservatism, whereas areas with constant human activity and mobility exhibit a rapid pace of linguistic change.

The most prominent differences between the urban and bedouin groups concern the consonantal inventory. Arabic dialectologists identified consonants that are characteristic of bedouin (or sedentarized bedouin) dialects and their correspondents in urban dialects—often making reference to the Old Arabic origins of these phonemes. These differences are outlined below (see Yushmanov 1961:9–12, Holes 1995:57–62 for a detailed discussion).

- REFLEXES OF THE OA INTERDENTALS /θ, ð, ðˤ/. Bedouin-type dialects retain the OA interdental fricatives /θ, ð, ðˤ/, whereas the city dialects have merged them with the dental plosives /t, d, dˤ/ respectively, or with the dental fricatives /s, z, zˤ/ in the case of more recent Standard Arabic loans.
- REFLEXES OF THE OA EMPHATICS /dˤ/ and /ðˤ/. The OA emphatics /dˤ/ and /ðˤ/ have merged into a single phoneme /ðˤ/ in bedouin dialects, while they are rendered as /dˤ/ and /zˤ/ in the urban dialects. As a consequence, the former group has a three-way contrast in the emphatic consonants, i.e., /tˤ, sˤ, ðˤ/; and the latter group has a corresponding four-way contrast, i.e., /tˤ, dˤ, sˤ, zˤ/ (see also Heselwood 1996).
- REFLEXES OF OA /ɖ/. The voiced palatoalveolar affricate /ɖ/ has been retained in the bedouin dialects. In the urban dialects, it has a variety of correspondents, most notably a palatoalveolar fricative /ʒ/ in the Levant and a velar plosive /g/ in (the cities of Lower) Egypt.
- REFLEXES OF OA /q/. The uvular /q/ is realized as a glottal stop /ʔ/ in the city dialects, and as a voiced velar plosive /g/ in the bedouin dialects. However, one must

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note that in both types of dialects the /q/ reflex is retained in a reasonable number of lexical items, and hence it must be regarded as an independent phoneme.

- REFLEXES OF OA /k/. The urban dialects have preserved this phoneme; while in the bedouin dialects it has undergone a process of affrication to /tʃ/ before front/high vowels (see §6.3 of this thesis). In certain bedouin dialects, a further change from /q/ to /dʒ/ or even to /j/ has taken place in those same environments.

A quick scan of the consonant inventories of Cairene and Baghdadi Arabic in (9) and (10) reveals that CA is characteristically urban and BA is characteristically bedouin. In addition to the above distinctions, the following may be pointed out:

- EMPHATIC SONORANTS. In CA there is a split between emphatic /rˤ/ and plain /r/, whereas in BA there is a split between emphatic /rˤ/ and plain /l/. These are determined on purely contrastive basis (see chapter 3).
- FOREIGN PHONEMES. The phonemes /v/ and /z/, although restricted to non-Arabic loanwords, are frequent and well established in present-day educated CA (Youssef 2006:18–9). BA, on the other hand, has a voiceless bilabial plosive /p/, found in a fair number of Farsi and English loanwords. And there is general agreement on its phonemic status in this dialect (see e.g., Altoma 1969:16, Abu-Haidar 2006:224).

(9) Chart showing 27 consonant phonemes in CA

	Labial		interdental		Dental		Palatal		Velar		Uvular	Pharyngeal		Glottal	
Plosive	b				t	tˤ	d	(dˤ)	k		g	q			ʔ
Fricative	f	(v)			s	sˤ	z	(zˤ)	ʃ	(ʃˤ)	x	χ	ħ	ʕ	h
Affricate															
Nasal	m				n										
Lateral					l										
Flap					r		(rˤ)								

(10) Chart showing 29 consonant phonemes in BA

	Labial		Interdental		Dental		Palatal		Velar		Uvular	Pharyngeal		Glottal	
Plosive	(p)	b			t	tˤ	d		k		g	q			ʔ
Fricative	f		(θ)	(ð ðˤ)	s	sˤ	z	ʃ		x	χ		ħ	ʕ	h
Affricate							(tʃ)		(tʃˤ)						
Nasal	m				n										
Lateral					l		(lˤ)								
Flap					r										

Subsequent chapters will investigate the consequences of these systematic typological differences on a range of interacting phonological processes. Consequences are both representational and computational, in the spirit of the Parallel Structures Model.

## CHAPTER 2

### Local Place Assimilation

#### 2.1 Background

Assimilation is a phonological process by which one segment (the target) takes on a feature or set of features of another segment (the trigger) within a specified domain. While some languages display long-distance assimilatory effects, the vast majority of assimilation processes obtain between strictly adjacent segments, hence the term *local assimilation*. Phonetically, local assimilation may be attributed to the minimization of articulatory effort, i.e., to avoid unnecessary shifts in stricture or place of articulation within a sequence of segments. Despite the obvious phonetic basis in coarticulation, the phonological machinery is far more complicated. Processes of local assimilation depend mainly on the featural decomposition and relative position of the segments involved (Baković 2007:336). For instance, a process that spreads labial and velar place features may affect only the class of nasal segments, and only those nasals that occupy the initial position in NC sequences. One such process may apply as long as its conditions are met, whereas other processes may be restricted by morphological considerations. In all varieties of Arabic, for example, the local assimilation of the definite article prefix /-/ to stem-initial coronal consonants (*//l-ruti:n //* → *r-ruti:n* ‘the routine’) does not apply in identical phonological environments elsewhere.

Local assimilation is a recurrent subject in the Arabic linguistic tradition. One remarkable instance is the eighth century linguist Sibawayh who devoted a complete chapter of his *al-Kitāb* to this topic. He uses the term *iḍghām*, which he defines as “the fusion of two adjacent segments by complete assimilation of the first one by the second to produce a geminate” (al-Nassir 1993:57). He also makes use of the terms *ibdāl* ‘replacement’ and *ixfāʾ* ‘concealing’ to refer to various subtypes of local assimilation both within words and across word boundaries. But Sibawayh’s explanations of *iḍghām* are rather complicated and not always consistent (Edzard 2000:59), especially when used as a broad cover term for all kinds and degrees of consonant assimilation (al-Nassir 1993:61). Ibn Jinni, another Medieval Arab linguist, differentiates between total and partial assimilation, and coins the terms *al-iḍghām al-akbar* ‘major assimilation’ and *al-iḍghām al-aṣghar* ‘minor assimilation’ (Alfozan 1989:

111). Although traditional Arab linguists were mainly concerned with the High form of Arabic especially in Quranic recitations (al-Hashmi 2004), they frequently quoted cases of local assimilation in the dialects of pre-Islamic Arabic tribes (Zemánek 2006: 205). Needless to say, many of these are attested in modern Arabic dialects today.

The present chapter explores local consonant-to-consonant place assimilations (henceforth LPA) in Cairene and Baghdadi Arabic. I provide a thorough descriptive overview of LPA in these two varieties; and for completeness' sake, I also consider various assimilations of manner features that are contingent on sharing place features. These processes include total assimilations in which case the adjacent sounds become identical (forming a false geminate), and partial assimilations in which case one consonant becomes more similar but not identical to a neighboring consonant. In terms of the direction of the influence, LPA in CA and BA exhausts all three possible options: regressive (anticipatory) with a backward influence of a sound on the preceding one; progressive (perseverative) with a forward influence of a sound on the following one; and reciprocal (coalescent) where the influence is both leftward and rightward, with both segments affecting one another.

This chapter confirms on the one hand that apparently similar processes display language-specific variability, captured by differences in feature specifications and natural classes of participating segments. Further, the observed assimilation patterns in Cairene and Baghdadi conform to cross-linguistic generalizations, suggesting that certain acoustic and/or articulatory factors regulate the amount of variability. These generalizations, explored in Jun (1995), are the position asymmetry (that regressive LPA is far more common than progressive LPA), the target place asymmetry (that coronal consonants are the most likely targets of assimilation), and the trigger place asymmetry (that non-coronals are more likely triggers of assimilation than coronals). These are believed to result from universal phonetic similarities.

In addition to the detailed descriptions, the chapter addresses a set of issues that arise in the formal analysis of LPA in autosegmental phonology and in Optimality Theory.<sup>1</sup> One is the role of the Obligatory Contour Principle (OCP) in the machinery of local assimilation and its potential interaction with epenthesis. Another is the view of assimilation as the indirect result of OCP violations (Watson 2002) or prominence-based faithfulness (Beckman 1998), as the direct result of a “spreading imperative” requiring a feature to extend its domain in the output (Padgett 1995), or even as a combination thereof. A final, and most challenging, issue is the incorporation of featural representations and autosegmental principles into the formulation of OT constraints, and the interaction of these constraints to provide unified grammars of Cairene and Baghdadi Arabic.

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<sup>1</sup> For an overview of local assimilation in modern phonological theory, see Zsiga (2011).

## 2.2 Local Place Assimilation in Cairene Arabic

This section provides a coherent and detailed analysis of local place assimilation in Cairene Arabic, the understanding of which has significant consequences on the size and structure of the consonant inventory. LPA in Cairene Arabic spans the variables: uni-directional vs. reciprocal and total vs. partial. Additionally, the assimilations are operative in consonant sequences within the phonological word and/or across word boundaries. And while many of these processes have been examined in the literature, various important details have been left out, not to mention the assimilations that have been largely ignored.

Thus to obtain a comprehensive picture, a data-elicitation task was conducted in which five native speakers of CA were given a list of words and short phrases, and were instructed to use them in sentences of their own making. The list included an extensive collection of potential LPA environments (in consonant sequences) as well as some fillers. The participants were two males and three females from different age groups, and except for one illiterate female speaker—used as control for educated CA—all of them have a university degree. Based on the collected data, a distinction is made between two types of variation: “intra-speaker” where a process is common in fast connected speech and rare in careful speech, and “inter-speaker” where a process is characteristic of a group of individuals but not of others, often with sociolinguistic factors involved.<sup>2</sup> I show that the difference between the two has implications for what is considered a collective grammar of CA.

The discussion is organized as follows. Sections 2.2.1 and 2.2.2 introduce the phonological distributions of morpheme-specific and general LPA (including other place-related assimilations). Some conclusions and generalizations concerning the natural classes of participating segments are established based on the data. Section 2.2.3 justifies feature specifications for all relevant segments in the PSM, and thereby provides autosegmental representations for the various assimilations. And finally section 2.2.4 proposes an optimality-theoretic analysis of LPA that goes hand in hand with the representations.

### 2.2.1 Morpheme-Specific Assimilations in CA

#### 2.2.1.1 Assimilation of the Definite Article *l-*

By far the most well-known type of assimilation in modern Arabic dialects as well as Old Arabic is the total assimilation of the definite article *l-* (henceforth *l*-assimilation; see Watson 2002:217 for references). The definite article in Cairene Arabic—as in all other varieties—has two forms. The consonantal prefix *l-* occurs in words beginning with the following consonants /b, m, f, v, x, ɣ, ħ, ʕ, h, ʔ/ and the semi-vowels /w, j/,

<sup>2</sup> To my knowledge, LPA in Cairene has not been studied from a sociolinguistic perspective, nor is it the purpose of this work to do so. However, my fieldwork revealed a few facts that are worth noting. First, the tendency of LPA is generally lower among women and among educated speakers. Moreover, it correlates positively with age, i.e., younger speakers tend to assimilate less often.

traditionally called the “moon letters” (1a). Note that in all these words, which begin with a consonant, the article appears as *ʔil-*. The reason is that Cairene does not allow consonant clusters in the onset, and resolves these by epenthesis of /i/ before the first consonant (then coda) and an epenthetic /ʔ/ onset where necessary.

Evidence that the definite article is underlyingly //l// rather than //il// is that it is realized as /l/ after vowels where it would be syllabified in the coda. One example is when the article follows a vowel-final word, as in *ʔil-ʕimārʕa l-ʕalja* ‘the tall building’ (see Abdel-Massih 1975:48). Further evidence comes from nouns and adjectives that begin with a glottal stop, which may belong to one of two types: words with inherent /ʔ/ (among the root radicals) and words with epenthetic /ʔ/ (not a root radical). The former type covers proper nouns that developed from OA /ʔ/ or /q/ and a few loanwords, and it generates an article /ʔil/ in phrase-initial position—some examples are included in (1a). The latter type comprises verbal nouns of measure VIII, masculine singular adjectives of color and physical defects of the form ʔaCCaC, certain loans with original consonant clusters in the onset, and a handful of other words (Abdel-Massih, Abdel-Malek, and Badawi 1979:84). In these cases, no glottal stop appears before the definite article, which is realized either as /l/ or /ʔill-/ , as shown in (1b).<sup>3</sup>

(1) The “moon letters” in simple and complex onsets

a.	<i>ʔil-bard</i>	‘the cold’	<i>ʔil-mijfʔ</i>	‘the comb’
	<i>ʔil-farʔ</i>	‘the rat’	<i>ʔil-villa</i>	‘the villa’
	<i>ʔil-xafab</i>	‘the wood’	<i>ʔil-yasi:l</i>	‘the laundry’
	<i>ʔil-ħubb</i>	‘the love’	<i>ʔil-ʕija:l</i>	‘the kids’
	<i>ʔil-hila:l</i>	‘the crescent’	<i>ʔil-ʔarʕaf</i>	‘the filth’
	<i>ʔil-ʔuma:f</i>	‘the fabric’	<i>ʔil-ʔutubi:s</i>	‘the bus’
	<i>ʔil-waraʔ</i>	‘the papers’	<i>ʔil-jahu:d</i>	‘the Jews’
b.	<i>ʔill-imtiħa:n</i>	~	<i>l-imtiħa:n</i>	‘the exam’
	<i>ʔill-ittisʕa:l</i>	~	<i>l-ittisʕa:l</i>	‘the call’
	<i>ʔill-aħmarʔ</i>	~	<i>l-aħmarʔ</i>	‘the red’
	<i>ʔill-iswid</i>	~	<i>l-iswid</i>	‘the black’
	<i>ʔill-ibwa:b</i>	~	<i>l-ibwa:b</i>	‘the doors’
	<i>ʔill-itneen</i>	~	<i>l-itneen</i>	‘the two’
	<i>ʔill-arbiʕi:n</i>	~	<i>l-arbiʕi:n</i>	‘the forty’
	<i>ʔill-ista:d</i>	~	<i>l-ista:d</i>	‘the stadium’
	<i>ʔill-isʔiwa:na</i>	~	<i>l-isʔiwa:na</i>	‘the cylinder’

The other form of the article prefix is a false geminate (a sequence of two identical consonants) which occurs in words beginning with the coronals /t, tʔ, d, dʔ, s, sʔ, z, zʔ, r, rʔ, ʃ, ʒ, l, n/, conventionally called the “sun letters”. Note that a stem-initial /l/ is ambiguous as a trigger of assimilation because it is identical to the target, but this has

<sup>3</sup> A few speakers pronounce the latter type with initial /ʔ/ as in *ʔil-ʔabwa:b* ‘the doors’ and *ʔil-ʔarbaʔ* ‘the Wednesday’, but this is limited to a posh upper-class style of speech (Woidich 2006a:123).



no consequences for the analysis. That said, total assimilation of the definite article *l-* before any of these consonants is obligatory (Salib 1981:6). And although heavily morphologized, the process is synchronically active, as evident from assimilations to initial coronals in recently adapted loanwords in CA (Watson 2002:219). The left-hand column in (2) shows assimilated native words, whereas the right-hand column shows assimilated loans. Since the dataset exhibits isolated (phrase-initial) forms, the article appears as /ʔiC/, but it may also appear as a single consonant C- if it follows a vowel-final word, as in *dabdu:ba t-tixi:na* (Abdel-Massih et al. 1979:43).

## (2) The obligatory “sun letters”

<i>ʔit-tixi:n</i>	‘the fat’	<i>ʔit-taksi</i>	‘the taxi’
<i>ʔid-deel</i>	‘the tail’	<i>ʔid-dibloom</i>	‘the diploma’
<i>ʔit<sup>ʕ</sup>-tʕabi:x</i>	‘the cooking’	<i>ʔit<sup>ʕ</sup>-tʕalja:n</i>	‘the Italians’
<i>ʔid<sup>ʕ</sup>-dʕalmə</i>	‘the darkness’	<i>ʔid<sup>ʕ</sup>-dʕanj<sup>ʕ</sup></i>	‘the dunk shot’
<i>ʔis-su:ʔ</i>	‘the market’	<i>ʔis-sinima</i>	‘the cinema’
<i>ʔis<sup>ʕ</sup>-sʕubḥ</i>	‘the morning’	<i>ʔis<sup>ʕ</sup>-sʕalsʕə</i>	‘the tomato sauce’
<i>ʔiz-zeet</i>	‘the oil’	<i>ʔiz-zinj<sup>ʕ</sup></i>	‘the zinc’
<i>ʔiz<sup>ʕ</sup>-zʕa:bit<sup>ʕ</sup></i>	‘the officer’	<i>ʔiz<sup>ʕ</sup>-zʕant<sup>ʕ</sup></i>	‘the wheel-rim’
<i>ʔif-fams</i>	‘the sun’	<i>ʔif-fi:k</i>	‘the check’
<i>ʔir<sup>ʕ</sup>-rʕa:qil</i>	‘the man’	<i>ʔir<sup>ʕ</sup>-rʕadju</i>	‘the radio’
<i>ʔir-raʕfa</i>	‘the trembling’	<i>ʔir-rizi:m</i>	‘the diet’
<i>ʔin-na:s</i>	‘the people’	<i>ʔin-nitt</i>	‘the internet’
<i>ʔil-loon</i>	‘the color’	<i>ʔil-lanʕun</i>	‘the luncheon meat’

Researchers seem to agree that *l*-assimilation is optional when the initial consonant is /k/ or /g/ (3a–b) (Gadalla 2000:16, Woidich 2006a:123). However, an interesting fact that is missed in all characterizations of CA is that the uvular stop /q/—although it has a very low functional load—optionally triggers assimilation of the definite article as well, indicating that /k, g, q/ form a natural class (see §2.2.3).<sup>4</sup> This is surprising since /q/ is often regarded as the most characteristic non-assimilating sound (in the Standard Arabic word *qamar* ‘moon’), and yet it has become a potential “sun letter” in CA (3c). The curly brackets in the examples indicate optionality between /l/ and one of these assimilating consonants.

## (3) The optional “sun letters”

a.	<i>ʔi{k}-kursi</i>	‘the chair’	<i>ʔi{k}-kʕorʕə</i>	‘the ball’
	<i>ʔi{k}-kibi:r</i>	‘the big’	<i>ʔi{k}-kari:m</i>	‘the generous’
	<i>ʔi{k}-kəmirʕə</i>	‘the camera’	<i>ʔi{k}-kafitiria</i>	‘the cafeteria’

<sup>4</sup> To my knowledge, /k, g, q/ triggers of *l*-assimilation are unique to CA. Robertson (1970:160) claims that all plosives (including /b/) can be triggers. However, this is often viewed as coarse, and it may not signify the educated variety under investigation.

b.	<i>ʔi{g}-gajj</i>	‘the coming’	<i>ʔi{g}-ga:mid</i>	‘the strong’
	<i>ʔi{g}-gibna</i>	‘the cheese’	<i>ʔi{g}-gazma</i>	‘the shoes’
	<i>ʔi{g}-ǧarʕa:z</i>	‘the garage’	<i>ʔi{g}-gaz</i>	‘the kerosene’
c.	<i>ʔi{q}-qurʕa:n</i>	‘the Quran’	<i>ʔi{q}-qahira</i>	‘Cairo’
	<i>ʔi{q}-qanu:n</i>	‘the law’	<i>ʔi{q}-qarja</i>	‘the village’
	<i>ʔi{q}-qarʕd</i>	‘the loan’	<i>ʔi{q}-qarʕn</i>	‘the century’

It is important to stress that *l*-assimilation in CA is a morpheme-specific process since //l// within any other morpheme fails to assimilate to a following coronal obstruent or velar stop, although it does assimilate to a following sonorant /n, r, r<sup>s</sup>/ (§2.2.2.1). The examples in (4) exhibit identical sequences to those in (2–3) above, but morpheme-internally where assimilation fails to take place (Watson 2002:218).

## (4) Non-assimilating /l/ morpheme-internally

<i>ʔiltiha:b</i>	‘swelling’	<i>məltʕaʕa</i>	‘laughingstock’
<i>ʔalday</i>	‘lispings’	<i>ʔaldʕum</i>	‘I thread’
<i>malsu:ʕ</i>	‘jumpy’	<i>ʔilsina</i>	‘tongues’
<i>ʔalsʕima</i>	‘temporary fix-up’	<i>malzu:ʔ</i>	‘glued MS’
<i>ʔalfa</i>	‘a miss (football)’	<i>ma ʕalf</i>	‘he didn’t carry’
<i>malku:z</i>	‘poked’	<i>malqaʕ</i>	‘sanctuary’

2.2.1.2 Assimilation of the Detransitivizing Prefix *t-*

The detransitivizing verbal prefix *t-*, which denotes passiveness or reflexivity, brings about another type of morphologized assimilation in CA. In default form, the prefix is realized as /t/ in post-vocalic position, as /it/ in post-consonantal position, and as /ʔit/ in phrase-initial position. This applies to stems beginning with a sonorant /n, l, r, r<sup>s</sup>/, a labial /b, f, m/, or a back consonant /x, ɣ, ħ, ʕ, ʔ, h/ (Watson 2002:222). I must note that in many verbs the prefix *t-* is interchangeable with *n-*, which may undergo another kind of assimilation (see §2.2.2.3).

(5) Non-assimilating *t-* of the detransitivizing prefix

<i>ʔit-habal</i>	‘he became crazy’	<i>ʔit-nakfu</i>	‘they teased one another’
<i>ʔit-rakab</i>	‘he was ridden’	<i>ʔit-rʕafaʕ</i>	‘it was lifted’
<i>ʔit-lafat-li</i>	‘he turned to me’	<i>ʔit-ħammil</i>	‘he bore’
<i>ʔit-fakkaraʕ</i>	‘he was reminded’	<i>ʔit-ʕajjin</i>	‘he was appointed’
<i>ʔit-baħħ</i>	‘it became hoarse’	<i>ʔit-maxwil</i>	‘he was perplexed’
<i>ʔit-xajal</i>	‘he was distracted’	<i>ʔit-ʕalab</i>	‘he was overcome’
<i>ʔit-ʔamaʕ</i>	‘he sulked’	<i>ʔit-wakas</i>	‘he was thwarted’

The detransitivizing prefix *t-* of measure V and VI verbs (and their participles) will undergo total assimilation to a following coronal stop /t, t<sup>s</sup>, d, d<sup>s</sup>/ and optionally to a following coronal fricative /s, s<sup>s</sup>, z, z<sup>s</sup>, ʃ, ʒ/ or a velar/uvular stop /k, g, q/ (cf. Gary and

Gamal-Eldin 1982:127, Woidich 2006a:325). These constitute a subset of the consonants that assimilate the definite article, the only exceptions being the sonorants /r, r<sup>h</sup>, n, l/. The obligatory assimilations exemplified in (6a) may also be accounted for by means of voicing and/or emphatic assimilation (see §2.2.2.4). The optionality of the other triggers is indicated by curly brackets in (6b–c).

(6) Total assimilation of the detransitivizing verbal prefix *t-*

a.	<i>?it-tarbis</i>	‘it was locked’	<i>?id-da:ra</i>	‘he hid’
	<i>?it<sup>h</sup>-t<sup>h</sup>awwaʔ</i>	‘he volunteered’	<i>m<sup>h</sup>it<sup>h</sup>-t<sup>h</sup>a:hir<sup>h</sup></i>	‘circumcised MS’
	<i>?it<sup>h</sup>-t<sup>h</sup>ar<sup>h</sup>baʔ</i>	‘it collapsed’	<i>?it<sup>h</sup>-t<sup>h</sup>allaʔ</i>	‘he was divorced’
	<i>?id<sup>h</sup>-d<sup>h</sup>axxam</i>	‘it inflated’	<i>m<sup>h</sup>id<sup>h</sup>-d<sup>h</sup>ar<sup>h</sup>ar<sup>h</sup></i>	‘harmed MS’
	<i>?id<sup>h</sup>-d<sup>h</sup>a:ʔif</i>	‘it was doubled’	<i>?id<sup>h</sup>-d<sup>h</sup>aʔat<sup>h</sup></i>	‘he was pressed’
b.	<i>?i{s}-sagan</i>	‘he was jailed’	<i>?i{s}-sa:biʔ</i>	‘he contended with’
	<i>?i{s}-sadd</i>	‘it was blocked’	<i>?i{s<sup>h</sup>}-s<sup>h</sup>ar<sup>h</sup>af</i>	‘he acted’
	<i>?i{s<sup>h</sup>}-s<sup>h</sup>adam</i>	‘he was shocked’	<i>m<sup>h</sup>i{s<sup>h</sup>}-s<sup>h</sup>awwar<sup>h</sup></i>	‘photographed MS’
	<i>?i{z}-zanaʔ</i>	‘he was cornered’	<i>?i{z}-zahlaʔ</i>	‘he slipped’
	<i>?i{z}-zawwaʔ</i>	‘it was decorated’	<i>?i{z<sup>h</sup>}-z<sup>h</sup>ar<sup>h</sup>wat<sup>h</sup></i>	‘it was messed up’
	<i>?i{z<sup>h</sup>}-z<sup>h</sup>ar<sup>h</sup>af</i>	‘he was bribed’	<i>?i{z<sup>h</sup>}-z<sup>h</sup>abat<sup>h</sup></i>	‘it was adjusted’
	<i>?i{ʃ}-ʃatam</i>	‘he was insulted’	<i>?i{ʃ}-ʃat<sup>h</sup>af</i>	‘he washed himself’
	<i>?i{ʃ}-ʃaʔbat<sup>h</sup></i>	‘he hanged on’	<i>m<sup>h</sup>i{ʃ}-ʃaʔat<sup>h</sup></i>	‘dragged around MS’
c.	<i>?i{k}-kabb</i>	‘it was poured’	<i>mi{k}-karmif</i>	‘wrinkled MS’
	<i>?i{k}-kawwim</i>	‘it was piled’	<i>mi{k}-kassaḥ</i>	‘crippled MS’
	<i>?i{g}-gammid</i>	‘it froze’	<i>mi{g}-gawwiza</i>	‘married FS’
	<i>?i{g}-gabbis</i>	‘he was plastered’	<i>?i{g}-gannin</i>	‘he went crazy’
	<i>?i{q}-qarin</i>	‘he was compared’	<i>?i{q<sup>h</sup>}-q<sup>h</sup>ar<sup>h</sup>ar<sup>h</sup></i>	‘it was decided’

Total assimilation of //t// to a following coronal fricative or velar/uvular stop fails to apply morpheme internally (e.g., *?atqan* ‘he perfected’) or when any other morphemes are involved (7a), indicating that it is a morphologized process (Watson 2002:222–3). The examples in (7b) show perfective measure V and VIII verbs that are derived by infixing *t-* after the first root consonant. In this case, the assimilation is not operative because the order of trigger and target is reversed (see also Hamid 1984:156).

(7) Non-assimilating *t-* in other morphemes

a.	<i>bit-siḥ</i>	‘it melts’	<i>bit-s<sup>h</sup>u:m</i>	‘you MS fast’
	<i>bit-zuʔʔ</i>	‘she pushes’	<i>bit-z<sup>h</sup>abbat<sup>h</sup></i>	‘you MS adjust’
	<i>bit-fukk</i>	‘she doubts’	<i>ma fakkit-f</i>	‘you MS didn’t doubt’
	<i>bit-kubb</i>	‘she pours’	<i>bit-gu:ʔ</i>	‘you MS get hungry’
b.	<i>?if-t-ayal</i>	‘he worked’	<i>?if-t-ara</i>	‘he bought’
	<i>?ik-t-afaf</i>	‘he discovered’	<i>?ik-t-amaʔu</i>	‘they assembled’
	<i>?is-t-alam</i>	‘he received’	<i>?is<sup>h</sup>-t-abaḥ</i>	‘he started off the morning’

## 2.2.2 General Assimilations in CA

## 2.2.2.1 Total Assimilation of Sonorants

The sonorant consonants //n, l, r, r<sup>s</sup>// may totally assimilate to each other in various ways. Due to consonant co-occurrence restrictions in roots, these assimilations rarely take place in stems (al-Nassir 1993:67), but they are common across morpheme and word boundaries (Watson 2002:237–8). Total assimilation of this type is characterized in the literature as anticipatory and optional (Harrell 1957:43). In this section, results from my fieldwork are presented, where all imaginable combinations and domains are taken into account.

The total assimilation of //n// to a following liquid /l, r, r<sup>s</sup>/ holds in all but the most careful speech of educated speakers. Except for one informant, all the others exhibited clear assimilation of the type in (8a–b). The non-assimilating informant is an educated upper-middle class female who has very clear ideas on what constitutes “prestige” vs. unsophisticated pronunciation (see Mitchell 1956:1). And only with great conscious effort was she able to escape assimilation in some test phrases. We conclude that //n// to /l, r, r<sup>s</sup>/ regressive assimilation is a robust trait of CA grammar.

(8) Regressive assimilation of //n// to /l, r, r<sup>s</sup>/ in CA

a.	//ka:n lu //	→	kal lu	‘he had’
	//ʔima:n liʕibit //	→	ʔimal liʕbit	‘Imān played’
	//mi:n lajla //	→	mil lajla	‘who is Layla?’
	//fain laħmit l-ʕi:d //	→	fil laħmit ilʕi:d	‘where is Eid’s meat?’
	//sukka:n libna:n //	→	sukkal libna:n	‘Lebanon’s population’
	//ħasan limid <sup>f</sup> //	→	ħasal liḡid <sup>f</sup>	‘Hasan is loquacious’
	//min l-tnain //	→	mil litneen	‘from both’
b.	//min riqlaih //	→	mir rigleeh	‘from his legs’
	//ħasan rikib //	→	ħasar rikib	‘Hasan rode’
	//min r <sup>s</sup> ħlit //	→	mir riħlit	‘from the trip of’
	//fain r <sup>s</sup> aqamak //	→	fir <sup>s</sup> r <sup>s</sup> aqamaḵ	‘where is your number?’
	//mi:n r <sup>s</sup> add //	→	mir <sup>s</sup> r <sup>s</sup> aḍḍ	‘who replied?’

Parallel to the above assimilation, //l// totally assimilates to a following /r, r<sup>s</sup>/. This assimilation is obligatory for all speakers of CA, as shown in (9). And it is the same as the assimilation of the definite article to /r, r<sup>s</sup>/ in §2.2.1.1 (cf. al-Qahtani 2004:44).<sup>5</sup>

(9) Obligatory regressive assimilation of //l// to /r, r<sup>s</sup>/

	//wa:kil riʕi:f //	→	wakir riʕi:f	‘eating a loaf (of bread)’
	//jiʕmil r <sup>s</sup> a:gił //	→	jiʕmir <sup>s</sup> r <sup>s</sup> a:gił	‘he pretends to be a man’
	//ħas'al r <sup>s</sup> aḍḍ //	→	ħas'ar <sup>s</sup> r <sup>s</sup> aḍḍ	‘a rejection occurred’

<sup>5</sup> On a somewhat related note, Woidich (2006a:15) reports the following /l~/r, r<sup>s</sup>/ and /n~/l/ alternations: *mīlahlaḥ*<sup>f</sup> ~ *mīr<sup>s</sup>ahlaḥ*<sup>f</sup> ‘flappy’, *ḡurḡa:l* ~ *ḡurḡa:n* ‘newspaper’, *ʔismaʕil* ~ *ʔismaʕin* ‘Ishmael’.

Three logical possibilities remain to be discussed. First is the total assimilation of //l// to a following /n/, which is particular to the illiterate informant. I conclude that the assimilating forms in (10a) are ungrammatical in educated CA. Second and third are the total assimilation of //r, r̥// to a following /n/ or /l/. None of my CA informants exhibited these assimilations in their speech, as shown in (10b–c).<sup>6</sup> When presented with the conceivable pronunciation in which assimilation occurs, they identified them as “very rare” or “typical of individuals with speech defects”. I conclude that total assimilation of //r, r̥// to /n, l/ is not active in the grammar of CA.

## (10) Unaccomplished regressive sonorant assimilations

- |    |  |                |                               |                             |
|----|--|----------------|-------------------------------|-----------------------------|
| a. | <i>malna</i> /* <i>manna</i>                   | ‘our business’ | <i>ʔu:lna</i> /* <i>ʔunna</i> | ‘we said’                   |
|    | <i>jiʕmil na:sʕiħ</i> /* <i>jiʕmin na:sʕiħ</i> |                |                               | ‘he pretends to be clever’  |
|    | <i>ʔakal nʕsʕʕu</i> /* <i>ʔakan nʕsʕʕu</i>     |                |                               | ‘he ate half of it’         |
| b. | <i>ʔarnab</i> /* <i>ʔannab</i>                 | ‘rabbit’       | <i>fʔr̥n</i> /* <i>funn</i>   | ‘bakery’                    |
|    | <i>safir najziria</i> /* <i>safin najziria</i> |                |                               | ‘he traveled to Nigeria’    |
|    | <i>naʔar̥ na:ʔis̥</i> /* <i>naʔan na:ʔis̥</i>  |                |                               | ‘missing passenger’         |
| c. | <i>ʔaʔr̥ laħma</i> /* <i>ʔaʔil laħma</i>       |                |                               | ‘having meat for breakfast’ |
|    | <i>xaʔar̥ laʔi:f</i> /* <i>xaʔal laʔi:f</i>    |                |                               | ‘pleasant news’             |
|    | <i>tamir liḡid̥</i> /* <i>tamil liḡid̥</i>     |                |                               | ‘Tāmir is loquacious’       |

Assimilation of sonorants to adjacent obstruents is active only in *l*-assimilation, but not elsewhere. And although a few descriptions of CA report an optional assimilation of //n// to /t/ in the words *kunt* ~ *kutt* ‘I was’ and *bint* ~ *bitt* ‘girl’,<sup>7</sup> these are lexical exceptions as becomes evident when they are compared to other words with similar sequences, like those in (11).

## (11) Lack of //n// regressive assimilation to /t/

- |  |              |                                |                     |
|--|--------------|--------------------------------|---------------------|
| <i>xunt</i> /* <i>xutt</i>             | ‘I betrayed’ | <i>ʔinta</i> /* <i>ʔitta</i>   | ‘you MS’            |
| <i>ʕaʔt̥a</i> /* <i>ʕaʔt̥a</i>         | ‘bag’        | <i>ʕintil</i> /* <i>ʕittil</i> | ‘gentle’            |
| <i>kan ta:ɡir</i> /* <i>kat ta:ɡir</i> |              |                                | ‘he was a merchant’ |
| <i>min tari:x</i> /* <i>mit tari:x</i> |              |                                | ‘from the date of’  |

## 2.2.2.2 Total Assimilation of Sibilants

The coronal fricatives /s, s̥, z, z̥, ʃ, ʒ/, aka sibilants, rarely come into contact within stems as a result of root consonant co-occurrence restrictions, but they may do so across morpheme and word boundaries. When two different sibilants are brought together within the phonological phrase, the leftmost is totally assimilated to the

<sup>6</sup> The only coarticulatory cue that I could recognize is the lack of release of the flaps /r, r̥/ before /n, l/ (only in the phrase domain), but no consequent lengthening/gemination of the latter was audible.

<sup>7</sup> One of my informants explained that she would only use the assimilated form *bitt* with a negative connotation, and the non-assimilated form *bint* otherwise.

rightmost, i.e., regressive assimilation (Abdel-Massih et al. 1979:43). On one hand, word-final //s, z, s<sup>ʕ</sup>, z<sup>ʕ</sup>// undergo total assimilation to a following palatoalveolar /ʃ/ or /ʒ/ (12). In case the target disagrees in voicing with the trigger, additional regressive voicing (or de-voicing) assimilation takes place. The sequences of //ʃ// followed by //ʒ// or vice versa are merely instances of these voicing assimilations, a discussion of which is out of place here. Total assimilation of adjacent sibilants is obligatory in CA except in the careful speech of a few upper-class speakers.

(12) Regressive assimilation of //s, z, s<sup>ʕ</sup>, z<sup>ʕ</sup>// to /ʃ, ʒ/ in the phonological phrase

- |    |                        |   |                 |                               |
|----|------------------------|---|-----------------|-------------------------------|
| a. | //libis fa:l //        | → | libif fa:l      | ‘he put on a shawl’           |
|    | //kanas fariʕ //       | → | kanaf fariʕ     | ‘he swept a street’           |
|    | //tu:nis far? //       | → | tunif far?      | ‘Tunis is east’               |
|    | //yaraz fauka //       | → | yaraf fooka     | ‘he inserted a thorn’         |
|    | //gawwiz fadja //      | → | gawwif fadja    | ‘he married Shadya’           |
| b. | //la:bis zinʒ //       | → | labiʒ zinʒ      | ‘wearing jeans’               |
|    | //laħas zila:ti //     | → | laħaʒ zila:ti   | ‘he licked ice cream’         |
|    | //ħagaʒ zi:ba //       | → | ħagaʒ zi:ba     | ‘he reserved a skirt’         |
|    | //ʕa:ʒiz ʒakitta //    | → | ʕa:ʒiz ʒakitta  | ‘I want a jacket’             |
| c. | //ħummuʕ fa:m //       | → | ħummuʕ fa:m     | ‘chickpeas’                   |
|    | //ʔurʔusʕ fwajja //    | → | ʔurʔuʕ fwajja   | ‘dance a little!’             |
|    | //ʔitya:zʕ fwajja //   | → | ʔityaʕ fwajja   | ‘he was annoyed a little’     |
|    | //ħafazʕ faklu //      | → | ħafaʕ faklu     | ‘he memorized his appearance’ |
| d. | //rʕaxxasʕ zimm //     | → | rʕaxxʒ zimm     | ‘he licensed a gym’           |
|    | //la:ħizʕ ʒakittitu // | → | laħiʒ ʒakittitu | ‘he noticed his jacket’       |

The example sets in (13) show the reverse order of the segments in (12), viz., //ʃ, ʒ// followed by /s, z, s<sup>ʕ</sup>, z<sup>ʕ</sup>/. The result is total assimilation to the rightmost segment, confirming that assimilation is regressive across word boundaries regardless of the nature of the participating segments. The optionality of this process has been noted in the literature, but this only applies to careful speech (see e.g., Abdel-Massih 1975:50).

(13) Regressive assimilation of //ʃ, ʒ// to /s, z, s<sup>ʕ</sup>, z<sup>ʕ</sup>/ in the phonological phrase

- |    |                       |   |                   |                              |
|----|-----------------------|---|-------------------|------------------------------|
| a. | //mafif sitta //      | → | mafif{s}sitta     | ‘there aren’t six (of them)’ |
|    | //mif sahl //         | → | mi{s}sahl         | ‘not easy’                   |
|    | //bala:f safa:la //   | → | bala{s}safa:la    | ‘stop being repulsive!’      |
|    | //farfif sa:ʕa //     | → | farfif{s}sa:ʕa    | ‘cheer up for an hour!’      |
| b. | //mif zaiju //        | → | mi{z}zaiju        | ‘not like him’               |
|    | //mafif zait //       | → | mafif{z}zeet      | ‘there is no oil’            |
|    | //maħaddif zaʕʕalu // | → | maħaddi{z}zaʕʕalu | ‘nobody upset him’           |
|    | //bala:f ziba:la //   | → | bala{z}ziba:la    | ‘no garbage!’                |
|    | //rʕauʒ zija:da //    | → | rʕu{z}zija:da     | ‘excess lipstick’            |

c.	//mafi:f s <sup>ʕ</sup> abr <sup>ʕ</sup> //	→	mafi{s <sup>ʕ</sup> }s <sup>ʕ</sup> abr <sup>ʕ</sup>	‘there is no patience’
	//mif s <sup>ʕ</sup> ħbi //	→	mi{s <sup>ʕ</sup> }s <sup>ʕ</sup> ħbi	‘not my friend’
	//ʕa:ji:f s <sup>ʕ</sup> ja:ʕa //	→	ʕaji{s <sup>ʕ</sup> }s <sup>ʕ</sup> ja:ʕa	‘he lives as a bum’
	//l-dibrija:ʒ s <sup>ʕ</sup> ad <sup>ʕ</sup> d <sup>ʕ</sup> a //	→	?iddibrija{s <sup>ʕ</sup> }s <sup>ʕ</sup> ad <sup>ʕ</sup> d <sup>ʕ</sup> a	‘the clutch has rusted’
d.	//mif z <sup>ʕ</sup> a:bit <sup>ʕ</sup> //	→	mi{z <sup>ʕ</sup> }z <sup>ʕ</sup> a:bit <sup>ʕ</sup>	‘not an officer’
	//maħaddif z <sup>ʕ</sup> ahar <sup>ʕ</sup> //	→	maħaddi{z <sup>ʕ</sup> }z <sup>ʕ</sup> ahar <sup>ʕ</sup>	‘nobody appeared’
	//l-mikja:ʒ z <sup>ʕ</sup> ulm //	→	?ilmikja{z <sup>ʕ</sup> }z <sup>ʕ</sup> ulm	‘the make-up is unfair’
	//bala:f z <sup>ʕ</sup> ur <sup>ʕ</sup> f //	→	bala{z <sup>ʕ</sup> }z <sup>ʕ</sup> ur <sup>ʕ</sup> f	‘stop feigning pleasantness!’

On the other hand, sibilant assimilation within the phonological word is progressive and the target is limited to the negation suffix //ʕ// (see Salib 1981:6). CA syllabification rules dictate that the two consonants be tautosyllabic, forming a coda cluster. When the leftmost sibilant is a voiceless /s/ or /s<sup>ʕ</sup>/, the target //ʕ// becomes identical to the trigger via progressive assimilation. When the leftmost sibilant is a voiced /z/ or /z<sup>ʕ</sup>/, it undergoes regressive de-voicing as well. This results in identical surface forms for trigger /s, z/ and for /s<sup>ʕ</sup>, z<sup>ʕ</sup>/, as exemplified in (14a–b). It is also worthwhile to note a certain amount of variation regarding these sequences. For example, no assimilation is observed in the careful speech of some educated speakers. Furthermore, the reverse (regressive) assimilation of non-emphatic //s, z// is detected among some speakers, resulting in surface /ʕʕ/ (see Harrell 1957:41). None of my informants exhibited this latter variation, however.

(14) Progressive assimilation of //ʕ// to /s, z/ and /s<sup>ʕ</sup>, z<sup>ʕ</sup>/ in the phonological word

a.	//ħabas + ma...f//	→	maħabass	‘he didn’t jail’
	//libis + ma...f//	→	malbiss	‘he didn’t get dressed’
	//fa:z + ma...f//	→	mafass	‘he didn’t win’
	//xabaz + ma...f//	→	maxabass	‘he didn’t bake’
	//gahhiz + ma...f//	→	magahhiss	‘he didn’t prepare’
b.	//xilis <sup>ʕ</sup> + ma...f//	→	maħlis <sup>ʕ</sup> s <sup>ʕ</sup>	‘it didn’t end’
	//ra <sup>ʕ</sup> a <sup>ʕ</sup> as <sup>ʕ</sup> + ma...f//	→	ma <sup>ʕ</sup> ra <sup>ʕ</sup> a <sup>ʕ</sup> as <sup>ʕ</sup> s <sup>ʕ</sup>	‘he didn’t dance’
	//ħafaz <sup>ʕ</sup> + ma...f//	→	maħafas <sup>ʕ</sup> s <sup>ʕ</sup>	‘he didn’t memorized’

Comparing the example sets in (12–13) and (14) where similar sequences undergo regressive and progressive assimilation, we can talk about two separate domains for sibilant assimilation: the phonological word and the phonological phrase.

### 2.2.2.3 Nasal Place Assimilation (Partial)

Nasal consonants in many languages are homorganic with a following obstruent (Padgett 1995). In Cairene, the alveolar nasal //n// assimilates in place to an immediately following /b, m, f, v, k, g, q, ʒ, ʒ/ consonant (cf. Woidich 2006a:19). Nasal place assimilation (henceforth NPA) is partial in nature; that is, the output sequences are similar in one or more features, but not in all. Regressive NPA in CA is obligatory

within the phonological word, but optional within the phonological phrase (Watson 2002:235). This section considers a range of NPA data involving diverse triggers.

Immediately to the left of the labial stops /b, m/, the alveolar nasal /n/ changes to a labial nasal /m/ (see Cantineau 1960:40). In case of a trigger /m/, NPA coincidentally results in a false geminate, as will be clarified in §2.2.3. The left-hand column in (15a) illustrates NPA in the word domain (in nouns and adjectives), while the alternations in the right-hand column provide evidence for underlying //n// in contexts where assimilation is not expected.<sup>8</sup> The example set in (15b) shows similar obligatory NPA in verbs, both stem internally (in imperfect verbs) and across morpheme boundaries (after the detransitivizing verbal prefix *n-*). (15c) exemplifies “optional” NPA in the phrase domain.

(15) Partial place assimilation of //n// to a following labial stop

a.	<i>ʃam̄bar<sup>f</sup></i>	‘ward’		<i>ʃana:bir</i>	‘wards’
	<i>ʃam̄bar<sup>f</sup></i>	‘frame (of glasses)’		<i>ʃana:bir</i>	‘frames’
	<i>tambal</i>	‘sluggard’		<i>tanabla</i>	‘sluggards’
	<i>zumba</i>	‘malicious trick’		<i>zunab</i>	‘malicious tricks’
	<i>?ambu:ba</i>	‘gas bottle’		<i>?anabi:b</i>	‘gas bottles’
	<i>?ambah</i>	‘more clever’		<i>nabi:h</i>	‘clever’
	<i>?am̄ma:t<sup>f</sup></i>	‘patterns’		<i>naṃaṭ<sup>f</sup></i>	‘pattern’
b.	<i>ji-mbiḥ</i>	‘he digs up’		<i>nabaḥ</i>	‘he dug’
	<i>ji-mmu</i>	‘he grows up’		<i>nama</i>	‘he grew’
	<i>?im-ball</i>	‘he got wet’	<i>but</i>	<i>?in-ḥall</i>	‘he was paralyzed’
	<i>?im-ḥaṣṣaṭ<sup>f</sup></i>	‘he became pleased’	—	—	—
	<i>?im-mala</i>	‘it was filled’	—	—	—
c.	// <i>jigannin balad</i> //	→	<i>jigannin{m}balad</i>	‘he drives all mad’	
	// <i>sa:kin biḥi:d</i> //	→	<i>saki{m}biḥi:d</i>	‘living far’	
	// <i>min mi:n</i> //	→	<i>mi{m}mi:n</i>	‘from whom?’	
	// <i>?itnain masagi:n</i> //	→	<i>?itni{m}masagi:n</i>	‘two prisoners’	
	// <i>taman maḥal</i> //	→	<i>tama{m}maḥal</i>	‘the price of a shop’	

The labial fricative /f/ (and the marginal phoneme /v/) triggers partial assimilation of a preceding and adjacent //n//, resulting in a labiodental nasal allophone [m̄] (Harrell 1957:40–1). This new segment is restricted to a NPA context, and is not part of the CA contrastive inventory. This assimilation is obligatory in the word domain (16a–b) and optional across phonological words (16c). In the latter domain, a nasal /m/ may assimilate the place of a following labial fricative, giving the same output [m̄].

<sup>8</sup> A large number of assimilating nouns do not show alternations between /n/ and /m/. Evidence for NPA (rather than underlying //m//) in these is entirely based on complementary distribution, namely the fact that no word exists where /n/ is adjacent to /b, m/ in the language.



## (16) Partial place assimilation of //n// to a following labiodental fricative

a.	<i>ʔa-[ŋ]fa:r<sup>s</sup></i>	‘passengers’	<i>na:fa:r<sup>s</sup></i>	‘passenger’
	<i>s<sup>h</sup>a[ŋ]f</i>	‘kind’	<i>ʔas<sup>h</sup>na:f</i>	‘kinds’
	<i>xu[ŋ]fis</i>	‘hippie’	<i>xana:fi:s</i>	‘hippies’
	<i>ʔa-[ŋ]faf</i>	‘more puffy’	<i>na:fi:f</i>	‘puffy’
b.	<i>ju-[ŋ]fux</i>	‘he blows’	<i>na:fax</i>	‘he blew’
	<i>ji-[ŋ]faʕ</i>	‘he benefits’	<i>na:faʕ</i>	‘he benefited’
	<i>ʔi[ŋ]-falaʔ</i>	‘it was spilt’	<i>but</i> <i>ʔin-ʔafal</i>	‘it was closed’
	<i>ʔi[ŋ]-fa:ʔaħ</i>	‘he was disgraced’	—	
	<i>ʔi[ŋ]-faʕas<sup>s</sup></i>	‘it was squashed’	—	
c.	<i>//min fauʔ//</i>	→	<i>mi{[ŋ]}fooʔ</i>	‘from above’
	<i>//l-maxzan fain//</i>	→	<i>ʔilmayza{[ŋ]}feen</i>	‘where is the storage?’
	<i>//ʔinwa:n villa//</i>	→	<i>ʔinwa{[ŋ]}villa</i>	‘address of a villa’
	<i>//hiʕa:m fa:him//</i>	→	<i>hiʕa{[ŋ]}fa:him</i>	‘Hisham understands’

The alveolar nasal //n// assimilates in place to velar //k, g// or uvular //q//.<sup>9</sup> The output is a velar nasal /ŋ/ (or its uvular nasal allophone [N]), which is not part of the Cairene contrastive inventory. The assimilation is always operative in the phonological word domain (in nouns, adjectives, and verbs), as exemplified in (17a–b). However, in the phrase domain, it may or may not apply (17c).

## (17) Partial place assimilation of //n// to a following velar/uvular stop

a.	<i>taŋk</i>	‘storage tank’	<i>tannik</i>	‘he became bloated (with food)’
	<i>ʕaŋkal</i>	‘hook’	<i>ʕana:kil</i>	‘hooks’
	<i>biŋg</i>	‘anesthetic’	<i>bannig</i>	‘he anesthetized’
	<i>ħaŋgara<sup>h</sup></i>	‘larynx’	<i>ħana:gir</i>	‘larynxes’
	<i>siŋga</i>	‘bayonet’	<i>siŋga</i>	‘bayonets’
	<i>fiŋga:l</i>	‘coffee cup’	<i>fanagi:l</i>	‘coffee cups’
	<i>ʔa-ŋgaħ</i>	‘more successful’	<i>na:giħ</i>	‘successful’
	<i>ʔa[N]qara</i>	‘Ankara’	—	
	<i>ʔa-[N]qa</i>	‘more pure’	<i>naqi</i>	‘pure’
b.	<i>ji-ŋkir</i>	‘he denies’	<i>na:ka:r<sup>s</sup></i>	‘he denied’
	<i>ji-ŋgid</i>	‘he rescues’	<i>na:ga:d</i>	‘he rescued’
	<i>ju-[N]qud</i>	‘he criticizes’	<i>na:qa:d</i>	‘he criticized’
	<i>ʔiŋ-ka:faħ</i>	‘he was pushed off’	<i>ʔin-ʕakaħ</i>	‘he was enraptured’
	<i>ʔiŋ-katam</i>	‘he was silenced’	—	

<sup>9</sup> Watson (2002) states that the labial nasal //m// may also assimilate the place of a following velar stop in the phonological word domain (p.237). However, this assimilation is characteristic of uneducated speech, and even there it occurs in very few words. For example, it may be heard in *muŋkin* ~ *mumkin* ‘possible’ and *ʕaŋka:ra<sup>h</sup>* ~ *ʕamka:ra<sup>h</sup>* ‘metal work’ but never in *ʔamkan* ‘it was possible’, *ʔamka:r<sup>s</sup>* ‘more deceptive’, *ʔamga:d* (male name), etc. This is evidence for lexicalization, rather than NPA.

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	<i>ʔiŋ-garaħ</i>	‘he was injured’	—
	<i>ʔi[N]-qarʔadʕ</i>	‘it became extinct’	—
c.	<i>//niswa:n kitirʕ//</i>	→	<i>niswa{ŋ}kitir</i> ‘a lot of women’
	<i>//zubu:n qa:mid//</i>	→	<i>zubu{ŋ}qa:mid</i> ‘a first-rate customer’
	<i>//min qamu:s//</i>	→	<i>mi{[N]}qamu:s</i> ‘from a dictionary’

Assimilation of //n// to a following velar fricatives //x, ɣ// has not been noted by any of the informants in either domain, as shown in (18a–b) (but see Khalafallah 1969:26 for Sa‘idi Egyptian Arabic and Hamid 1984:146 for Sudanese Arabic). This confirms a general tendency for fricatives not to participate in NPA (Padgett 1991, 1994). In CA this applies only to velar, but not labial, fricatives.

### (18) Lack of NPA before the velar fricatives //x, ɣ//

a.	<i>mīnɣarʕ</i>	‘nostril’	<i>manxul</i>	‘flour sieve’
	<i>ʔanxa:b</i>	‘toasts’	<i>ʔanxaɣ</i>	‘more fibbing’
	<i>manyu:li</i>	‘Mongolian’	<i>ʔanya:m</i>	‘musical sounds’
	<i>tanyi:za</i>	‘a poke’	<i>taŋɣi:sʕ</i>	‘irritating’
b.	<i>//min ɣairʕ//</i>	→	<i>min ɣeer</i>	‘without’
	<i>//ka:n xairʕ//</i>	→	<i>kan xeer</i>	‘it was good’

Lastly, //n// assimilates in place to the left of a palatoalveolar fricative //ʃ, ʒ// (Watson 2002:242). This type of NPA is rarely mentioned since it results in a segment at a nearby (place of) articulation. Upon the lack of an IPA symbol for a palatoalveolar nasal, I use a centralization diacritic over the grapheme, as in /i̠/.

### (19) Partial place assimilation of /n/ to a following palatoalveolar

a.	<i>ʔa̠ɲɣaf</i>	‘drier’	<i>na:ɲif</i>	‘dry’
	<i>ʔa̠ɲɣatʕ</i>	‘more energetic’	<i>na̠ɲi:tʕ</i>	‘energetic’
	<i>mu̠ɲɣid</i>	‘religious chanter’	<i>na̠ɲi:d</i>	‘religious chant’
	<i>i̠ɲɣalla</i>	‘God willing’	<i>maɣalla</i>	‘fantastic!’
b.	<i>j̠u-ɲɣurʕ</i>	‘he saws’	<i>na̠ɣarʕ</i>	‘he sawed’
	<i>ji-ɲɣil</i>	‘he pickpockets’	<i>naɣal</i>	‘he pickpocketed’
	<i>ʔi̠ɲ-ɣaɣatʕ</i>	‘he was sucked in’	—	
	<i>ʔi̠ɲ-ɣaʔʔ</i>	‘it was split’	—	
c.	<i>//min ɣarʔ l-dilta//</i>	→	<i>mi{ɲ}ɣarʔ iddilta</i>	‘from east of the Delta’
	<i>//ti:n ɣauki//</i>	→	<i>ti{ɲ}ɣooki</i>	‘prickly pear’
	<i>//lisa:n ɣurʒ//</i>	→	<i>lisa{ɲ}ɣurʒ</i>	‘George’s tongue’

#### 2.2.2.4 Coronal Place Assimilation

Coronal place assimilation (henceforth CPA), is a phonological process requiring that adjacent coronal consonants agree in place of articulation (Pajak and Baković 2010).

This section is devoted to the discussion of two subtypes of CPA attested in Cairene, both of which involve target coronals.

First, a coronal stop //t, t̤, d, d̤// merges with a following palatoalveolar fricative //ʃ, ʒ// to form an affricate, as shown in (20a–d). The process is obligatory within or across phonological words, and whether the affricate is /tʃ/ or /dʒ/ depends on the voicing of the trigger //ʃ// or //ʒ// rather than the target (which undergoes voicing assimilation). The output segments of this process are interesting in two respects: (i) they are non-contrastive in the CA inventory; and (ii) they entail coalescence, in which case spreading operates bidirectionally on the two adjacent sounds to produce a single segment that shares properties of both—with no audible release and a shorter duration than a sequence of two obstruents.

(20) Merge of //t, t̤, d, d̤// with a following palatoalveolar fricative //ʃ, ʒ//			
a.	//mit-fa:l //	→	mitʃa:l ‘carried’
	//mit-fajjik //	→	mitʃajjik ‘looking chic’
	//ʃtarait ʃibʃib //	→	ʃiʃtaraitʃibʃib ‘I bought slippers’
	//r̤abat̤ fa:lu //	→	r̤aʃabat̤ fa:lu ‘he tied his shawl’
	//ʔat̤ʃa:n //	→	ʔaʃʃa:n ‘thirsty’
b.	//madʃu:ʃ //	→	matʃu:ʃ ‘smashed’
	//xadʃ //	→	xatʃ ‘scratch’
	//wa:d ʃaʔi //	→	watʃaʔi ‘a naughty boy’
	//mar̤ad̤ ʃidi:d //	→	mar̤aʃad̤ ʃidi:d ‘serious illness’
	//r̤afad̤ ʃuyluhum //	→	r̤aʃafad̤ ʃuyluhum ‘he rejected their work’
c.	//malait ʒirkin //	→	malidʒirkin ‘I filled a jerkin’
	//na:dit ʒaun //	→	nadiʒoon ‘she called John’
	//xabat̤ ʒiha:n //	→	xaʒabat̤ ʒiha:n ‘he hit Jihan’
d.	//ʔaki:d ʒaukar̤ //	→	ʔakiʒoʒkar̤ ‘it must be a joker’
	//ħasad ʒibitha //	→	ħasaʒibitha ‘he envied her skirt’
	//ħaud̤ ʒila:ti //	→	ħuʒila:ti ‘a container of ice cream’

Sections 2.2.2.1 and 2.2.2.2 showed, among other things, how a plain sonorant //l, r// or a plain sibilant //s, z, ʃ, ʒ// totally assimilates to a following emphatic /r̤/ or /s̤, z̤/, respectively. In fact, the regressive spreading of the emphatic feature from /t̤, d̤, s̤, z̤, r̤/ to contiguous plain consonants in C<sub>1</sub>C<sub>2</sub> sequences can be generalized to all coronals. This means that any plain coronal //t, d, s, z, l, r// in C<sub>1</sub> position will turn into its emphatic cognate. The assimilation is partial since only the emphatic feature spreads, and anticipatory since the reverse order impedes spreading. And although related to the process of emphasis spread (§3.2), it applies in a different domain here, namely, the phonological phrase. Another difference is that the target and trigger must be homorganic and strictly adjacent, which justifies why it is treated under LPA. Note that the example sets in (21a–b) may involve regressive voicing assimilation as well.

## (21) Assimilation of plain coronals to adjacent emphatics

a.	//yatit t <sup>h</sup> ħn //	→	yatit <sup>h</sup> t <sup>h</sup> ħn	‘very unpleasant (person)’
	//ʔaħmad t <sup>h</sup> wi:l //	→	ʔaħmat <sup>h</sup> t <sup>h</sup> wi:l	‘Ahmad is tall’
	//balad d <sup>h</sup> ʔajiʔa //	→	balad <sup>h</sup> d <sup>h</sup> ʔajiʔa	‘a lost country’
	//wa:d s <sup>h</sup> ʔajiʔ //	→	wat <sup>h</sup> s <sup>h</sup> ʔajiʔ	‘a good-for-nothing boy’
	//bait r <sup>h</sup> ʔauʔa //	→	bit <sup>h</sup> r <sup>h</sup> ʔauʔa	‘a magnificent house’
b.	//la:bis s <sup>h</sup> u:f //	→	labis <sup>h</sup> s <sup>h</sup> u:f	‘wearing wool’
	//ʔa:ʒiz s <sup>h</sup> and <sup>h</sup> ʔal //	→	ʔa:ʒis <sup>h</sup> s <sup>h</sup> and <sup>h</sup> ʔal	‘I want sandals’
	//birwa:z z <sup>h</sup> ʔa:ħir <sup>h</sup> //	→	birwaz <sup>h</sup> z <sup>h</sup> ʔa:ħir <sup>h</sup>	‘a projecting frame’
	//maħbu:s z <sup>h</sup> ulm //	→	maħbuz <sup>h</sup> z <sup>h</sup> ulm	‘jailed unjustly’
	//xamas d <sup>h</sup> ʔafa:d <sup>h</sup> ʔiʔ //	→	xamaz <sup>h</sup> d <sup>h</sup> ʔafa:d <sup>h</sup> ʔiʔ	‘five frogs’

## 2.2.2.5 Non-Coronal Place Assimilation

This section examines two types of non-coronal place assimilation that have received minimal attention in the literature. The first is total assimilation of a coronal stop /t, t<sup>h</sup>, d, d<sup>h</sup>/ to a labial /b/ or velar /k, g/ (see Abdel-Massih 1975:27). This occurs optionally in fast/casual speech in the phonological phrase domain (22b), but not in the word domain (22a).<sup>10</sup> Because not all coronals participate in CPA equally, parallel assimilations of fricatives do not occur.

(22) Assimilation of coronal stops /t, t<sup>h</sup>, d, d<sup>h</sup>/ to /b, k, g/

a.	katba /*kabba	‘writing FS’	jidbaħ /*jibbaħ	‘he slaughters’
	maṭḥaḥ /*maḥḥaḥ	‘kitchen’	maṭḥaḥa / *maḥḥaḥa	‘printing house’
	nadga /*nagga	‘resulting FS’	matku:k /*makku:k	‘tamped down’
b.	//ʃtarait bar <sup>h</sup> u:ka //	→	ʔiʃtari{b}ba <sup>h</sup> u:ka	‘I bought a wig’
	//nafad bigildu //	→	nafa{b}bigildu	‘he saved his skin’
	//yilit <sup>h</sup> kitir //	→	yili{k}kitir	‘he erred a lot’
	//baʃat kita:b //	→	baʃa{k}kita:b	‘he sent a book’
	//wa:d gadaʔ //	→	wa{g}gadaʔ	‘a decent boy’
	//ʃaut <sup>h</sup> gami:l //	→	ʃu{g}gami:l	‘a beautiful half (football)’

The other assimilation applies in C<sub>1</sub>C<sub>2</sub> sequences composed of a non-coronal stop followed by a homorganic fricative (cf. Hamid 1984:157). That is to say, /b/ followed by /f, v/ or /k, g/ followed by /x, ɣ/, as exemplified in (23a). The process applies on the phrase level since these sequences are absent word-internally. Importantly, the reverse order, fricative followed by a stop, does not trigger such assimilation. Two examples are given in (23b).

<sup>10</sup> None of my informants exhibited this type of CPA in the phonological word domain. But based on personal experience, I am aware that a few uneducated speakers have assimilation in words like (22a). This is usually stigmatized as vulgar.

- (23) Assimilation of non-coronal stops /b, k, g/ to their homorganic fricatives
- |    |                                      |   |                      |                    |
|----|--------------------------------------|---|----------------------|--------------------|
| a. | // <i>ħisa:b fa:dʕi</i> //           | → | <i>ħisaf fa:dʕi</i>  | ‘an empty account’ |
|    | // <i>ʔalfɑ:b vidju</i> //           | → | <i>ʔalfav vidju</i>  | ‘video games’      |
|    | // <i>samak xafi:f</i> //            | → | <i>samax xafi:f</i>  | ‘light fish’       |
|    | // <i>ħigag ɣarʕi:ba</i> //          | → | <i>ħigay ɣari:ba</i> | ‘strange excuses’  |
| b. | // <i>ʃaix kibi:r<sup>s</sup></i> // | → | <i>ʃix kibi:r</i>    | ‘an old sheikh’    |
|    | // <i>ħadaf biʕi:d</i> //            | → | <i>ħadaf biʕi:d</i>  | ‘he threw away’    |

### 2.2.2.6 //h//Place Assimilation

An interesting type of local assimilation is the total assimilation of the laryngeal fricative //h// to an immediately following or preceding velar or pharyngeal fricative //x, ɣ, ħ, ʕ// (Abdel-Massih et al. 1979:43–4, Harrell 1957:38, 42). When the target is a voiced //ɣ// or //ʕ//, regressive de-voicing—to /x/ or /ħ/—also occurs (cf. Abumdas 1985:145). Due to consonant co-occurrence restrictions in roots, these sequences are rarely found in a phonological word (an exception is //maʕhad//→maħħad ‘institute’). However, on the phonological phrase level, we do observe regressive assimilation in words that end in //h// when followed by a word-initial trigger (24a) and progressive assimilation in words that begin in //h// (especially *h-* of the third person object and possessive suffixes) when preceded by a word-final trigger (24b–c).

- (24) Regressive and progressive assimilation of //h// to /x, ɣ, ħ, ʕ/
- |    |                                  |   |                          |                            |
|----|----------------------------------|---|--------------------------|----------------------------|
| a. | // <i>ʃabah xa:lu</i> //         | → | <i>ʃabax xa:lu</i>       | ‘resembling his uncle’     |
|    | // <i>minabbih ɣa:li</i> //      | → | <i>minabbiy ɣa:li</i>    | ‘an expensive alarm clock’ |
|    | // <i>fawa:kɪh ɣarʕi:ba</i> //   | → | <i>fawakiy ɣari:ba</i>   | ‘exotic fruits’            |
|    | // <i>kiriħ ħaja:tu</i> //       | → | <i>kiriħ ħaja:tu</i>     | ‘he hated his life’        |
|    | // <i>nadah ʕalaih</i> //        | → | <i>nadaʕ ʕalee</i>       | ‘he called him’            |
| b. | // <i>dawwax-hum</i> //          | → | <i>dawwaxxum</i>         | ‘he made them dizzy’       |
|    | // <i>dima:ɣ-ha</i> //           | → | <i>dimaxxa</i>           | ‘her head’                 |
|    | // <i>r<sup>s</sup>auħ-ha</i> // | → | <i>r<sup>s</sup>uħħa</i> | ‘her spirit’               |
|    | // <i>bita:ʕ-hum</i> //          | → | <i>bitaħħum</i>          | ‘theirs’                   |
| c. | // <i>dima:ɣ ha:jila</i> //      | → | <i>dimax xajla</i>       | ‘a marvelous head’         |
|    | // <i>l-nusax hina</i> //        | → | <i>ʔinnusax xina</i>     | ‘the copies are here’      |
|    | // <i>bita:ʕ halwasa</i> //      | → | <i>bitaħ ħalwasa</i>     | ‘hallucinatory’            |
|    | // <i>balaħ hindi</i> //         | → | <i>balaħ ħindi</i>       | ‘Indian dates’             |

Having introduced all attested cases of local assimilation in CA, let us now attempt a featural analysis of the participating segments under the Parallel Structures Model. As pointed out in chapter 1, representations must be based on contrast and phonological activity.

### 2.2.3 Features and Representations in CA Local Place Assimilation

#### 2.2.3.1 Features and Natural Classes

The types of assimilation described in the previous sections involve the entire Cairene consonant inventory. The aim of this section is to characterize their featural makeup according to their behavior as natural classes, knowing that phonological processes impact specific families of segments rather than random sets. Several of these consonants are the focus of other phonological processes in subsequent chapters, and the reader may be referred to the relevant chapter for justification of certain features.

Let us start with the natural class of [coronal] segments, the most recurrent class cross linguistically (Jun 1995:12). What immediately springs to mind in this context is the assimilation of the definite article, for which the obligatory triggers /t, t̪, d, d̪, s, s̪, z, z̪, ʃ, ʒ, r, r̪, l/—leaving /n/ for the time-being—correspond almost exactly to consonants with a coronal place of articulation. Since this pattern alone provides no evidence as to which node the [coronal] feature is attached, I will call it  $\alpha$ -place[cor].

A subclass of the above consonants are the coronal stops, viz., /t, t̪, d, d̪/, which are equivalent to one natural class of CPA targets. If we hypothesize that a C-manner [closed] feature indicates a stop constriction, then the coronal stops /t, t̪, d, d̪/ and the surface-only affricates /tʃ, dʒ/ must have this feature. Another category of C-manner [closed] segments are the non-coronal stops /b, k, g/ which trigger various assimilations. Given that all seven phonemes show contrastive evidence for a place feature, we are left with the glottal stop /ʔ/ to be assigned a single C-manner[closed] feature. A placeless specification for /ʔ/ is supported by its behavior as an epenthetic consonant in CA (see Rose 1996:108).

Another subclass is the coronal fricatives /s, s̪, z, z̪, ʃ, ʒ/. They are a natural class because sibilant assimilation (§2.2.2.2) is confined to these segments. Parallel to the stops, we may hypothesize that a C-manner[open] feature indicates the fricative constriction of these segments. The non-coronal fricatives /f, v, x, ɣ/ have this feature, but they also have a place feature since they participate in other assimilations (see below). It follows that /h/ is the placeless fricative segment (see Harris 1990:268), in view of its tendency to delete in word-final position (Birkeland 1952) and its readiness to assimilate totally to other segments.

Sibilant assimilation provides evidence for a split in the [coronal] feature. Unlike the coronal stops, which are targets of CPA, coronal fricatives comprise targets and triggers of sibilant assimilation. They can be divided into two subgroups, /s, s̪, z, z̪/ and /ʃ, ʒ/, which assimilate regressively to each other. Since they share a feature  $\alpha$ -place[cor] in addition to C-manner[open], any assimilation will imply a difference as to which node the [coronal] feature is attached. In the PSM, this is interpreted as two instantiations of [coronal] under the C-place and V-place nodes. From an articulatory point of view, it seems natural that the alveolar /s, s̪, z, z̪/ have C-place[cor], whereas the palatoalveolar /ʃ, ʒ/ have V-place[cor] (since their articulation is closer to that of palatal glides). Supporting evidence for this classification comes from CPA of /t, t̪, d, d̪/ to following /ʃ, ʒ/. The result of this coalescence is an affricate /tʃ, dʒ/, which could

in principle be the outcome of coronal palatalization (see §6.2.4). It follows that /ʃ, ʒ/ and /tʃ, dʒ/ have V-place[cor] while /s, s<sup>ʕ</sup>, z, z<sup>ʕ</sup>/ and /t, t<sup>ʕ</sup>, d, d<sup>ʕ</sup>/ have C-place[cor].

Two further distinctions among the obstruents are found. First, some C-laryngeal feature, call it [voice], is necessary to distinguish the pairs: /s, z/, /t, d/, /s<sup>ʕ</sup>, z<sup>ʕ</sup>/, /t<sup>ʕ</sup>, d<sup>ʕ</sup>/, /ʃ, ʒ/, /tʃ, dʒ/. I follow Lombardi (1991) and Abu-Mansour (1996) in that [voice] in Arabic is a privative feature that is unspecified in sonorants (cf. Kabrah 2011). The exact nature of voicing assimilation, however, is beyond the scope of this work (see e.g., Iosad 2012a for a discussion of voicing in substance-free phonology). Another distinction is that between the plain-emphatic pairs /t, t<sup>ʕ</sup>/, /d, d<sup>ʕ</sup>/, /s, s<sup>ʕ</sup>/, /z, z<sup>ʕ</sup>/, and /r, r<sup>ʕ</sup>/, where shifts from one group to the other are characteristic of CPA. Since all of these segments have C-place[cor] and some C-manner specification, I posit that emphatic /t<sup>ʕ</sup>, d<sup>ʕ</sup>, s<sup>ʕ</sup>, z<sup>ʕ</sup>, r<sup>ʕ</sup>/ have an additional V-place[dor] feature (to be explored in §3.2.3).

Next are the consonants /b, m, f, v/, which trigger the NPA of //n// to a labial or labiodental nasal. For present purposes, I will simply posit the feature C-place[lab] to characterize this natural class. Considering the facts of NPA and non-coronal place assimilation, all four segments must have one or more manner features.

The velar stops /k, g/ and the uvular /q/ trigger NPA of //n// to a velar or uvular nasal, and they optionally trigger *l*-assimilation. I infer that a velar-uvular distinction is not contrastive in CA. Hence, /k, g, q/ make up one natural class of C-place[dor] segments. Of these, only /k, g/ trigger non-coronal LPA of /t, t<sup>ʕ</sup>, d, d<sup>ʕ</sup>/ as a result of their additional C-manner[closed] feature. It follows that /q/ is composed of a single C-place[dor] feature. On the other hand, the velar fricatives /x, ɣ/ form a partial class of //h//-place assimilation triggers, and I propose that they are also specified for C-place[dor]. An extra C-manner[open] feature explains their behavior as a “negative natural class” for NPA.

The segments /ħ, ʕ/ are part of the natural class /x, ɣ, ħ, ʕ/, which triggers regressive and progressive assimilation of //h//. There is no contrastive evidence from CA to support a C-place[dor] specification of /ħ, ʕ/ (nor any other place feature). They definitely share a C-manner[open] feature with /x, ɣ/. And I propose that /ħ, ʕ/ have an extra V-manner[open] feature in view of the fact that they condition a low front vowel /a/ in some contexts (§4.2.2). Phonetically, this ties with their approximant-like articulation (Ghazeli 1977:43–9, Catford 1988:96).

Next are the nasal sonorants /n, m, ŋ/. As a starting point, let us hypothesize that more sonorous segments are characterized by a combination of C-manner[closed] and C-manner[open] features. This is articulatorily tenable since nasal stops have both a stop closure and a continuous airflow. The fact that /n/ is the target, but seldom the trigger, of various types of assimilation hints at a placeless (weaker) articulation.<sup>11</sup> Thus I propose that /n/ is only composed of C-manner[closed] and C-manner[open].

<sup>11</sup> The modern concept of nasal place underspecification (Kiparsky 1985) resonates with Sibawayh’s explanation for /n/’s propensity to assimilate to other consonants. According to al-Nassir (1993:68), Sibawayh maintains that “the nasal property of /n/ is sufficient to indicate its status as a phoneme; and changes in its place of articulation within the limits of the mouth cavity would still indicate its value as an independent segment”.

On the other hand, the role of labial nasal /m/ in NPA confirms its C-place[lab] feature in addition to these manner features. Note that the labiodental nasal [ɱ], which results from NPA from a trigger /f, v/, is featurally identical to [m]; and indeed the two are in complementary distribution; i.e., they are allophones. Also, the velar nasal [ŋ] and its articulatorily proximate uvular nasal [ɴ] are in complementary distribution since they are conditioned by NPA from a velar or uvular stop trigger, respectively. I conclude that they are featurally indistinguishable, with C-place[dor] in addition to C-manner[closed] and C-manner[open].

We are left to deal with the liquids /r, r<sup>s</sup>, l/. The sonorant flaps /r, r<sup>s</sup>/ trigger total assimilation of //l, n//, but never the other way around. This suggests that /r, r<sup>s</sup>/ are structurally more complex than /n, l/. Hence they are composed of C-manner[closed] and C-manner[open] added to their proposed C-place[cor] feature, and an additional V-place[dor] to mark emphatic /r<sup>s</sup>/. This means that no distinction is made between flaps and nasals in terms of sonority. Finally, the lateral sonorant /l/ is a structurally simplex segment that is targeted by various types of assimilation. I suggest that it is only composed of a C-place[cor] feature. (See p.256 for a summary of all features).

### 2.2.3.2 Autosegmental Representations

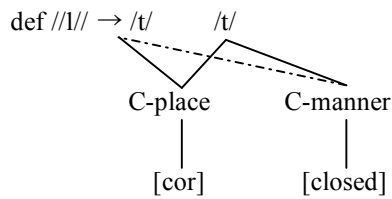
This section characterizes CA local assimilations in autosegmental phonology based on the aforementioned PSM feature specifications. Each of the assimilating features is assigned to an independent tier of representation, and extends its domain to include other adjacent elements that undergo the assimilatory process (Pulleyblank 1995:6). Assimilation is represented by a dotted line connecting the highest possible structure (feature or class node) from the trigger to the target.

Following the order of presentation in §2.2, I start with the total assimilation of the definite article. The main motivation behind this process is “an OCP violation on the coronal tier” (Watson 2002:220), rejecting representations in which each segment is linked to its own copy of the feature. Such violations can be circumvented through: (i) deleting one of the features; or (ii) merging both features into one. Although the OCP does not indicate *per se* how the violating derivations are made to conform to it (Odden 1988:454), I presume the second alternative, fusion, is the prioritized repair strategy because it implies no cost to faithfulness. As illustrated in (25a), the resulting sequence with shared PLACE creates the morpheme-specific environment in which the C-manner feature has to spread leftwards (the spreading node is meant for expository simplification), and the output is a false geminate /tt/. On the other hand, the fact that the V-place[cor] consonants /ʃ, ʒ/ trigger the same process calls for a representational option where OCP is violated by a place feature [coronal] attached to different nodes (cf. Selkirk 1988). To represent this visually as merge would require a third dimension, which explains why the place nodes in diagram (25b) appear as if they spread and delink. What actually happens is a special type of fusion in which the rightmost place node dominates (represented by a solid line); one that is clearly distinguished from spreading a new feature. This sets the context for spreading the C-manner feature leftwards.

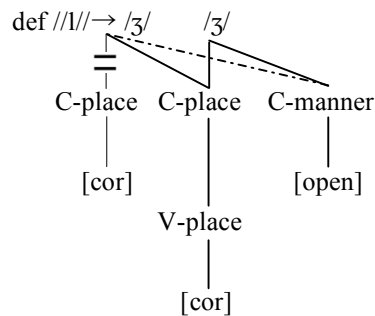


(25) *l*-assimilation to C-place[cor] and V-place[cor] segments

a. //l-taksi// → ?it-taksi



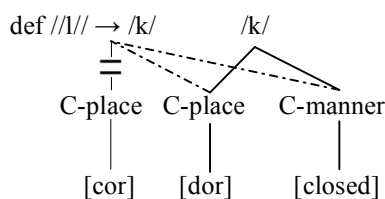
b. //l-ʒantʰ// → ?iʒ-ʒantʰ



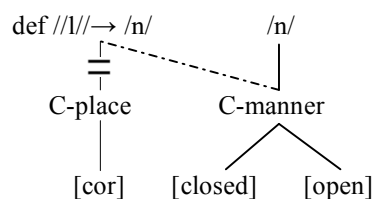
The optional non-coronal triggers /k, g, q/ do not involve an OCP violation, hence the mechanism involves spreading C-place[dor] with the simultaneous deletion of the target's C-place[cor] feature (26a). Finally, *l*-assimilation to the placeless trigger /n/ requires a mechanism by which both C-manner features spread leftwards together with delinking the target's [coronal] feature (26b).

(26) *l*-assimilation to non-coronal segments

a. //l-kursi// → ?ik-kursi



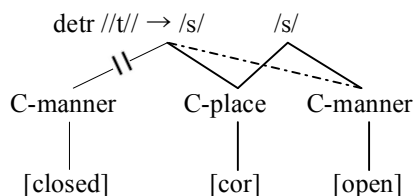
b. //l-na:s// → ?in-na:s



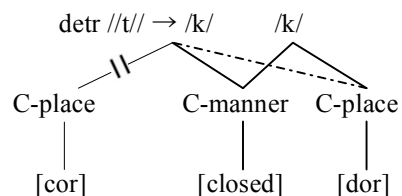
Likewise, the total assimilation of the detransitivizing *t*- takes place via two separate mechanisms. The first applies with the triggers /t, tʰ, d, dʰ, s, sʰ, z, zʰ, ʃ, ʒ/, in which case there is an OCP [cor] violation—within or across tiers—and a morpheme-specific requirement to spread (features of) the rightmost manner node in this domain (27a). Assimilation motivated by /k, g, q/ invokes a distinct mechanism, as shown in (27b).

(27) Total assimilation of the detransitivizing verbal prefix *t*-

a. //t-sagan// → ?is-sagan



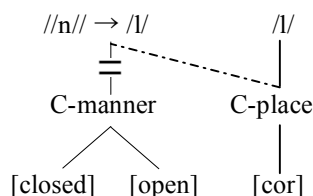
b. //t-kawwim// → ?ik-kawwim



Next we characterize processes of general assimilation in CA, starting with the total regressive (generally obligatory) assimilation of sonorants. The assimilation of //n// to a following lateral /l/ entails right-to-left spreading of C-place[cor] and delinking of /n/'s C-manner features. Diagram (28) shows that the C<sub>1</sub>C<sub>2</sub> domain must not have any

features in common, which can justify why other C-place[cor] segments fail to trigger the assimilation. Nevertheless, this kind of domain is problematic to the analysis, and I opt to leave out this sound change for future investigation.

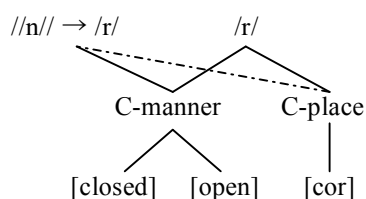
(28) Total assimilation of //n// to a following /l/: //ka:n lu// → kal lu



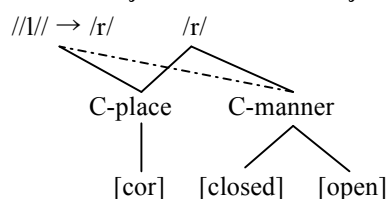
The domain for //n// to /r, r<sup>s</sup>/ assimilation is generated by an OCP violation when the participating segments agree in sonority. Once the features C-manner[closed] and C-manner[open] merge, spreading of the place feature takes place, as shown in (29a). Note that the exact same mechanism accounts for NPA from a trigger /m/, where the C-place node has a [labial] feature. On the other hand, the total assimilation of //l// to a following /r, r<sup>s</sup>/ (29b) is created by an OCP violation on C-place[cor], which has the consequence of forcing both features on the C-manner node to spread leftwards (cf. Watson 2002:238).

(29) Total assimilation of //n// and //l// to a following /r, r<sup>s</sup>/

a. //ħasan rikib// → ħasar rikib



b. //wakil riyi:f// → wakir riyi:f

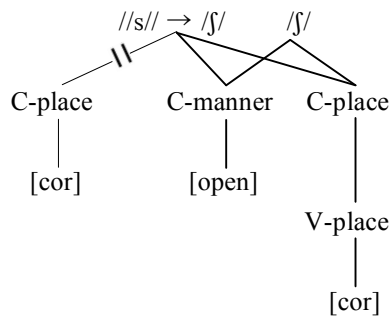


The local assimilation of sibilants includes two main subtypes. In regressive sibilant assimilation across phonological words, illustrated in (30a), the domain is created by double OCP violations on C-manner[open] and on [coronal] across tiers. The change from //s// to /ʃ/ takes place through fusion: dominance of the rightmost place node with the simultaneous deletion of the leftmost. Assimilation of the negation suffix //ʃ// to the sibilants /s, z, s<sup>s</sup>, z<sup>s</sup>/ applies in the opposite direction, as illustrated in (30b). Again, the domain is created by double OCP violations on C-manner[open] and on [coronal] across tiers. Here, a morpheme-specific requirement to spread the leftmost place node overrides the default right-to-left direction of assimilation.<sup>12</sup>

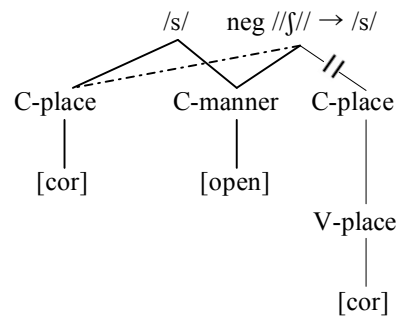
<sup>12</sup> The progressive direction of assimilation in this position is perceptually motivated: distinctive word-final, post-consonantal place is more difficult to perceive than post-vocalic place (Baković 2007:349, see also Steriade 2001).

## (30) Total assimilation of sibilants: regressive and progressive

a. //libis fa:l// → libif fa:l



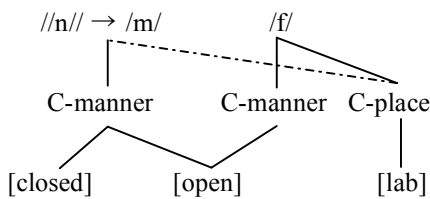
b. //ħabas + ma...ʃ// → maħabass



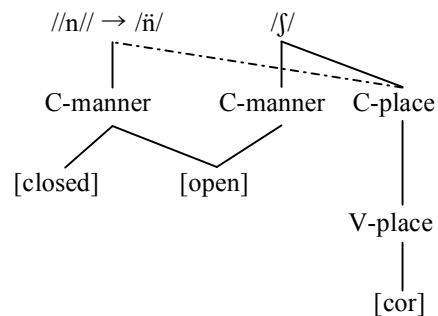
Nasal place assimilation entails regressive spreading of three place features: C-place [lab], C-place[dor], and V-place[cor]. The process is restricted to a target //n// that is articulatorily weak in terms of its position (coda), its nasality, and its lack of a place feature (cf. Watson 2002:235). Unlike other processes of total assimilation, NPA is partial and it involves spreading of place features only. The representations in (31a–d) display various triggers of NPA, namely labials, palatal fricatives, velar stops, and the uvular stop /q/.<sup>13</sup>

## (31) Partial nasal place assimilation to various triggers

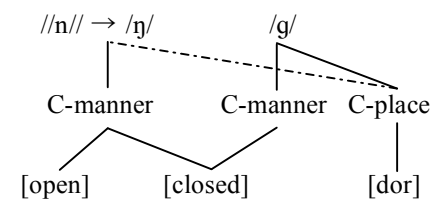
a. //xunfis// → xu[m]fis



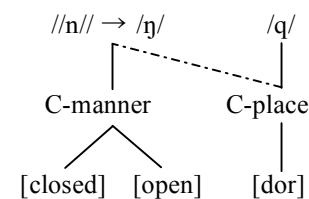
b. //ʔanfaf// → ʔa[n]faf



c. //fiŋa:l// → fiŋa:l



d. //ʔanqa// → ʔa[N]qa

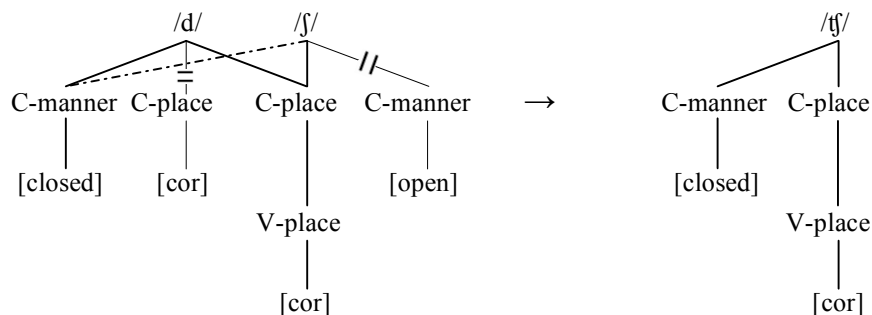


As described in §2.2.2.4, coronal place assimilation comprises two distinct subtypes. First is the merge of a coronal stop //t, tʰ, d, dʰ// with a palatoalveolar fricative //ʃ, ʒ// into an affricate /tʃ/ or /dʒ/. As shown in (32), an OCP [cor] violation across tiers leads to fusion by dominance of the rightmost place node (together with regressive voicing

<sup>13</sup> Recall that //m// also assimilates to a following labiodental /f, v/, giving the output allophone [m]. This is merely an instance of phonetic coarticulation since no feature changes are observed.

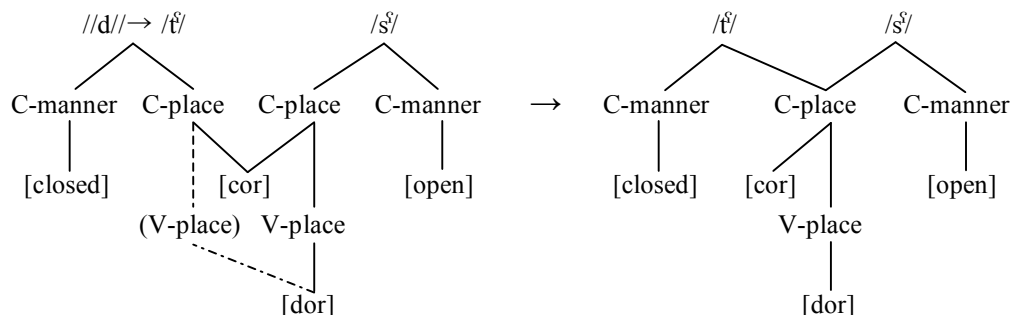
assimilation).<sup>14</sup> A direct requirement to spread C-manner[closed] rightwards and the consequent loss of C-manner[open] results in the new segment /tʃ/.

(32) Assimilation of //d// and //ʃ// to an output /tʃ/: //madʃut// → matʃut



The second type of CPA is the partial assimilation of plain coronals //t, d, s, z, l, r// to following emphatics. As illustrated in (33), the assimilation machinery involves: (i) merging the adjacent C-place[cor] features to avoid an OCP violation, and (ii) spreading the emphatic feature V-place[dor] (along with voicing specification) leftwards (cf. Watson 2002:243–4). It is irrelevant whether the target and trigger share a C-manner feature or not.

(33) CPA of plain //d// to an emphatic /sʕ/: //wa:d sʕajiŋ// → watʕ sʕajiŋʕ

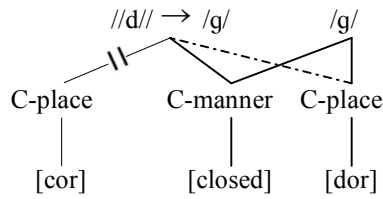


The total (optional) assimilation of a coronal stop //t, tʕ, d, dʕ// to a labial /b/ or velar /k, g/ is motivated by an OCP violation on C-manner[closed]. Once the target and trigger merge their manner features, right-to-left spreading of the place feature simply follows (34a), but only on the phrase domain. On the other hand, the assimilation of the non-coronal stops /b, k, g/ to their homorganic fricatives /f, v, x, ʁ/ follows the same mechanism as the assimilation of detransitive *t-* above: sharing of C-place[lab] or C-place[dor] due to an OCP violation and a requirement to spread C-manner[open] leftwards in this domain, with the simultaneous deletion of the target's C-manner [closed] feature. This is illustrated in (34b).

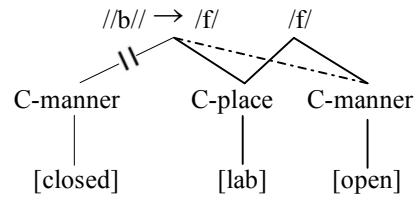
<sup>14</sup> One may wonder why a coronal fricative //s, sʕ, z, zʕ// does not merge with a preceding //t, tʕ, d, dʕ//. The reason is that sharing a C-place[cor] feature alone (due to an OCP violation) does not result in any change in the target. Hence no subsequent change occurs to the C-manner features.

(34) Total assimilation of stops to a following non-coronal obstruent

a. //wa:d gadaʕ// → wa{g}gadaʕ



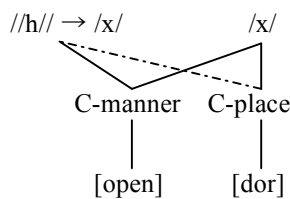
b. //ħisa:b fa:dʕi// → ħisaf fa:dʕi



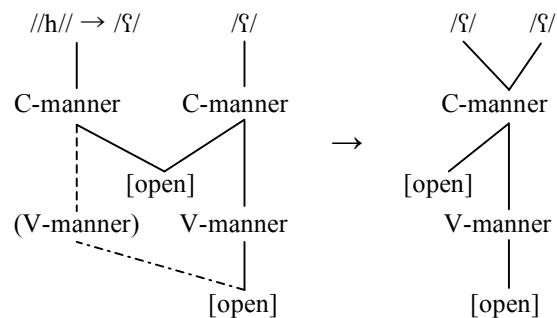
Finally, I consider the bidirectional assimilation of the laryngeal fricative //h// to a contiguous velar or pharyngeal fricative /x, ɣ, ħ, ʕ/. Again, the domain is created by an OCP violation, this time on C-manner[open]. Once two segments merge C-manner[open], the features C-place[dor] and V-manner[open] are required to spread leftward or rightward, as shown in (35a–b). Only the pairs /x, ɣ/ and /ħ, ʕ/ structurally combine these spreading features with C-manner[open]; hence no other segment may trigger the assimilation.

(35) Total assimilation of //h// to homorganic /x, ɣ/ and /ħ, ʕ/

a. //fabah xa:lu// → fabax xa:lu



b. //nadaħ ʕalaih// → nadaʕ ʕalee



#### 2.2.4 Constraints and Local Place Assimilation in CA

A major downside to optimality-theoretic accounts of assimilation is their indifference to feature hierarchies in the grammar, although autosegmental representations are generally assumed (Zsiga 2011). In response to this line of research, the current section incorporates unified feature representations into an OT analysis of LPA in Cairene. The patterns emerge from the interaction of general and morpheme-specific alignment constraints that refer to certain features, faithfulness constraints against feature insertion and deletion, and constraints referring to the OCP. Once again, we will follow the order of presentation in §§2.2.1–2.2.2.

The morphologized assimilations of the definite article *l-* and of detransitive *t-* are motivated by an OCP [coronal] violation where the feature [coronal] may belong to the same or different place nodes. This unorthodox view of the OCP requires the formulation in (36a) which does not specify the participating node for [cor]. While traditional OCP [feature] constraints are inviolable in all assimilation domains, OCP constraints that apply across tiers are violable in certain domains. Another important markedness constraint is NOGEM (36b), based on Rose (2000) and Baković (2005),

which penalizes both true and false geminates. Thus for any total assimilation to be optimal, this constraint must be low ranked.

(36) a. OCP [cor]: Assign one violation mark for adjacent [cor] features.

b. NOGEM: Single consonantal melodies that are associated with adjacent timing slots are disallowed in the output.

The morphologically-indexed constraint enforcing *l*-assimilation in (37a) belongs to the alignment family of constraints, which ensure the nearest possible coincidence of edges of phonological constituents (McCarthy and Prince 1993). The direction of assimilation is predetermined in the constraint formulation rather than by any independent factors, and the domain is a  $C_1C_2$  sequence where  $C_1$  is the definite article and where  $C_1$  and  $C_2$  share some [coronal] feature.<sup>15</sup> This constraint is in conflict with DEPLINK faithfulness constraints that militate against feature spreading; (37b–c) prohibit linking C-manner features to segments that are not linked in the input.

(37) a. L-ALIGN C-manner[F]/ $C_{\text{def}}C_{[\text{cor}]}$ : Given an output  $C_1C_2$  sequence where  $C_1$  is the definite article, if  $C_1$  and  $C_2$  share a feature [cor], then the left edge of C-manner[F] must be aligned to the left edge of the sequence.


b. DEPLINK C-[open]: Do not associate C-manner[open] to a segment that did not have it underlyingly.

c. DEPLINK C-[closed]: Do not associate C-manner[closed] to a segment that did not have it underlyingly.

Tableau (38) illustrates *l*-assimilation to coronal stops, or equally to sonorant triggers /r, r̥/ with multiple C-manner features. The highly ranked OCP [cor] prohibits two adjacent [coronal] features in (38a). A candidate that avoids this violation by sharing the [cor] feature (38b) satisfies the condition for ALIGNMENT; and is thus ruled out by L-ALIGN C-manner[F]/ $C_{\text{def}}C_{[\text{cor}]}$ . Candidate (c) emerges as optimal—though violating DEPLINK C-[closed] and NOGEM—because it aligns its C-manner feature to the left edge of the domain.<sup>16</sup>

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<sup>15</sup> This incorporates the idea behind Baković’s (2007) phonetically grounded constraint STR/PL, stating that “adjacent output segments that have the same place feature must also have the same stricture feature” (p.340). He claims that STR/PL addresses the articulatory difficulty of a single (assimilated and therefore extended) place of articulation with a change in stricture.

<sup>16</sup> Following OT practice, ranked constraints are shown in domination order (separated by solid lines), whereas unranked constraints are separated by dotted lines. Violation marks are indicated by “\*”, and fatal violations by a subsequent “!”. Below these fatal violations, shaded cells indicate a constraint’s irrelevance to determining the output. The optimal candidate is called out by “”.

(38) OCP [cor], L-ALIGN C-manner[F]/C<sub>def</sub>C<sub>[cor]</sub> >> DEPLINK C-[closed], NOGEM

	//l-taksi//	OCP [cor]	L-ALIGN C-manner [F]/C <sub>def</sub> C <sub>[cor]</sub>	DEPLINK C-[closed]	NOGEM
a.		*!			
b.			*!		
c.				*	*

The above ranking applies to triggers /ʃ, ʒ/ with a V-place[cor] feature, where OCP [cor] is violated across tiers. But since fusion of [coronal] is not direction-specific, the need arises to ensure dominance of the rightmost place node. I resort to positional faithfulness constraints referring to faithfulness violations in the first and second positions of the sequence respectively (39a–b). The crucial ranking DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub> in (39) predicts an output with shared V-place[cor].

- (39) a. DEPLINK [cor]/C<sub>1</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, do not associate a feature [cor] to a segment in C<sub>1</sub> position that did not have it underlyingly.
- b. DEPLINK [cor]/C<sub>2</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, do not associate a feature [cor] to a segment in C<sub>2</sub> position that did not have it underlyingly.
- c. OCP [cor], L-ALIGN C-manner[F]/C<sub>def</sub>C<sub>[cor]</sub>, DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub>, DEPLINK C-[open], NOGEM

The non-coronal triggers /k, g, q/ require different machinery: the basic constraint (40a)—which demands alignment of C-place[dor] to the definite article—is ranked above DEPLINK C-[dor]. While this suffices for the mannerless /q/, the velar stops /k, g/ require the constraint in (40b), which enforces alignment of C-manner[closed] to a sequence sharing C-place[dor]. Finally, (40c) is a constraint formulated through local conjunction (Smolensky 1997) militating against C-place[cor] segments that acquire additional C-place[dor]. This will naturally outrank MAX C-[cor].

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- (40) a. L-ALIGN C-[dor]/C<sub>def</sub>C<sub>[dor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence where C<sub>1</sub> is the definite article, the left edge of C-place[dor] must be aligned to the left edge of the sequence.
- b. L-ALIGN C-[closed]/C<sub>def</sub>C<sub>[dor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence where C<sub>1</sub> is the definite article, if C<sub>1</sub> and C<sub>2</sub> share C-place[dor], then the left edge of C-manner[closed] must be aligned to the left edge of the sequence.
- c. DEPLINK C-[dor] & \*C-[cor]: Do not associate C-place[dor] to a segment that has C-place[cor] on the surface.

The interaction of these constraints is demonstrated in Tableau (41). Candidates (a) and (b) incur fatal violations of alignment constraints. On the other hand, (41d) falls victim to DEPLINK C-[dor] & \*C-[cor], a violation that can be avoided by deleting C-place[cor] from the target. As a consequence, the optimal output (41c) turns out as the least faithful. Since *l*-assimilation to /k, g, q/ is optional, the grammar with no assimilation selects the reverse ranking where FAITH >> ALIGNMENT.

- (41) L-ALIGN C-[dor]/C<sub>def</sub>C<sub>[dor]</sub>, L-ALIGN C-manner[F]-C<sub>def</sub>C<sub>[dor]</sub>, DEPLINK C-[dor] & \*C-[cor] >> MAX C-[cor], DEPLINK C-[dor], DEPLINK C-[closed], NOGEM

	//l-kursi//	L-ALIGN C-[dor]/ C <sub>def</sub> C <sub>[dor]</sub>	L-ALIGN C-manner[F]/ C <sub>def</sub> C <sub>[dor]</sub>	DEPLINK C-[dor] & *C-[cor]	MAX C-[cor]	DEPLINK C-[dor]	DEPLINK C-[closed]	NOGEM
a.		*!						
b.			*!		*	*		
c.					*	*	*	*
d.				*!		*	*	



The assimilation of detransitive *t*- requires, in addition to OCP [cor], the morpheme-specific alignment imperative in (42a) parallel to the one that demands *l*-assimilation. Since the triggers /t, t̥, d, d̥/ simply share their C-manner feature with the target //t// to avoid OCP violation, I will concentrate on the fricative triggers /s, s̥, z, z̥, ʃ, ʒ/. Spreading C-manner[open] from these segments involves violation of the constraint in (37b) above. Moreover, (42b) is a constraint formulated through local conjunction, and it militates against C-manner[closed] segments that acquire additional C-manner [open].

- (42) a. L-ALIGN C-manner[F]/C<sub>detr</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence where C<sub>1</sub> is the detransitive prefix, if C<sub>1</sub> and C<sub>2</sub> share a feature [cor], then the left edge of C-manner[F] must be aligned to the left edge of the sequence.
- b. DEPLINK C-[open] & \*C-[closed]: Do not associate C-manner[open] to a segment that has C-manner[closed] on the surface.

The lateral sonorant /l/ is not a trigger since it has no C-manner feature to align. As the other sonorant liquids /r, r̥/ are not triggers either, the crucial ranking DEPLINK C-[open] & \*C-[closed] >> ALIGNMENT becomes necessary. Therefore, an assimilating output /rr/—which spreads C-manner[open] to a target with an underlying C-manner [closed]—is worse than the non-spreading output /tr/.

The following tableau examines assimilation to a trigger /ʃ/. Here, OCP violation applies across tiers and the crucial ranking DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub> is again relevant, but to simplify matters I do not consider suboptimal outputs that share C-place[cor]. Candidate (43c) aligns the trigger's C-manner feature but retains its original C-manner[closed] feature, thus falling victim to DEPLINK C-[open] & \*C-[closed]. The latter constraint crucially outranks MAX C-manner[closed], which is violated by the optimal candidate (43d).<sup>17</sup>

<sup>17</sup> The non-coronals triggers /k, g, q/ require a machinery corresponding to the one proposed for *l*-assimilation. To avoid repetition, see Tableau (41) above.

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(43) OCP [cor], DEPLINK C-[open] & \*C-[closed] >> L-ALIGN C-manner[F]/C<sub>detr</sub>C<sub>[cor]</sub> >> DEPLINK C-[open], MAX C-[closed], NOGEM

	//t-ʃatam //	OCP [cor]	DEPLINK C-[open] & *C-[closed]	L-ALIGN C-manner [F]/C <sub>detr</sub> C <sub>[cor]</sub>	DEPLINK C-[open]	MAX C-[closed]	NOGEM
a.		*!					
b.				*!			
c.			*!		*		
d.					*	*	*

Next I examine two instances of the regressive assimilation of sonorants triggered by /r, r<sup>h</sup>/. The first process targets the nasal //n// and requires the alignment constraint in (44). This constraint demands aligning C-place[cor] in C<sub>1</sub>C<sub>2</sub> sequences where the target and trigger share both C-manner[closed] and C-manner[open] (referring to both features as a unit). It is in conflict with DEPLINK C-[cor].

(44) L-ALIGN C-[cor]/C<sub>SON</sub>C<sub>SON</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share both C-manner[closed] and C-manner[open], then the left edge of C-place[cor] must be aligned to the left edge of the sequence.

Tableau (45) shows that violations of OCP C-manner[F] (where [F] refers to [closed] or [open]) and L-ALIGN C-[cor]/C<sub>SON</sub>C<sub>SON</sub> are not tolerated, and candidate (45c) wins by surpassing both of these top-ranked constraints. Remember that a potential target

//m// does not assimilate, indicating that ALIGNMENT is ranked below OCP C-manner [F] and DEPLINK C-[cor] & \*C-[lab].

(45) OCP C-manner[F] >> L-ALIGN C-[cor]/C<sub>SON</sub>C<sub>SON</sub> >> DEPLINK C-[cor], NOGEM

	//min rihlit //	OCP C-manner[F]	L-ALIGN C-[cor]/C <sub>SON</sub> C <sub>SON</sub>	DEPLINK C-[cor]	NOGEM
a.		*!*			
b.			*!		
c.				*	*

The other case of regressive sonorant assimilation targets the lateral //l// following /r, r̥/. The alignment imperative involved here (46a) is, in one way, the mirror image of (44): it demands conjoined alignment of C-manner[closed] and C-manner[open] (as a unit) in C<sub>1</sub>C<sub>2</sub> sequences where the target and trigger merge C-place[cor]. Since this is not place assimilation, I will only indicate the ranking in (46b).

(46) a. L-ALIGN C-[closed, open]/C<sub>[cor]</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-place[cor], then the left edge of C-manner[closed, open] must be aligned to the left edge of the sequence.

b. OCP [cor], L-ALIGN C-[closed, open]/C<sub>[cor]</sub>C<sub>[cor]</sub> >> DEPLINK C-[open], DEPLINK C-[closed], NOGEM

Regressive sibilant assimilation requires no alignment constraints since the target and trigger share C-manner[open] and [cor]. Assimilation here occurs as fusion to repair OCP [cor] violation across tiers. As shown in Tableau (47), fusion requires the same crucial ranking in (39c)—DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub>—which dictates directionality preference. Were this ranking reversed, candidate (47c) would emerge as the winner.

(47) OCP C-manner[F], OCP [cor], DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub>, NOGEM

	//libis ʃa:l //	OCP C-manner[F]	OCP [cor]	DEPLINK [cor]/C <sub>2</sub>	DEPLINK [cor]/C <sub>1</sub>	NOGEM
a.		*!	*!			
b.			*!			
c.				*!		*
d.					*	*

The morphologized assimilation of the negation suffix *-ʃ* to the sibilants /s, z, s<sup>ʃ</sup>, z<sup>ʃ</sup>/ seems to imply the opposite ranking: DEPLINK [cor]/C<sub>1</sub> >> DEPLINK [cor]/C<sub>2</sub>. Since this is not an option in the selfsame OT grammar, we must introduce the morpheme-specific alignment constraint in (48a) which crucially dominates DEPLINK [cor]/C<sub>2</sub>.<sup>18</sup> As a result of the ranking in (48b), a candidate that looks structurally similar to (47c) in the regressive assimilation would emerge as the winner.

(48) a. R-ALIGN C-[cor]/C<sub>[cor]</sub>C<sub>neg</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence where C<sub>1</sub> is the negation suffix, if C<sub>1</sub> and C<sub>2</sub> share C-manner[open], then the right edge of C-place[cor] must be aligned to the right edge of the sequence.

b. OCP C-manner[F], OCP [cor], R-ALIGN C-[cor]/C<sub>[cor]</sub>C<sub>neg</sub> >> DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub>, NOGEM

<sup>18</sup> Stuart Davis (p.c.) suggests an alternate analysis whereby Stem-FAITH >> Affix-Faith.

The above types of spreading are classified under total assimilation, where the output is always a false geminate. Nasal place assimilation, however, is partial where only the place feature aligns to the nasal target in NC configurations (sequences in which a nasal consonant is strictly adjacent to the triggering oral consonant). In the spirit of Padgett's (1995) NPA constraint, I formulate the three alignment constraints in (49a–c) that correspond to the assimilating features.

- (49) a. L-ALIGN C-[lab]/C<sub>1</sub>C<sub>2</sub>: For every NC sequence, the left edge of C-place[lab] must be aligned to the left edge of the sequence.
- b. L-ALIGN C-[dor]/C<sub>1</sub>C<sub>2</sub>: For every NC sequence, the left edge of C-place[dor] must be aligned to the left edge of the sequence.
- c. L-ALIGN V-[cor]/C<sub>1</sub>C<sub>2</sub>: For every NC sequence, the left edge of V-place[cor] must be aligned to the left edge of the sequence.

The first two alignment imperatives result in the non-contrastive segments /ŋ/ and /ñ/, respectively. Therefore, the output of ALIGNMENT will always violate markedness constraints against these feature combinations, as in (50a–b). Spreading C-place[lab], on the other hand, creates a contrastive segment /m/, and the relevant constraint is one against inserting this place feature to an underlying nasal //n// (50c). Finally, the constraint in (50d) is meant to disfavor velar fricatives /x, ɣ/ as triggers of NPA. Since triggers of C-place[dor] assimilation are only stops, outputs in which the trigger and target share C-manner[open] are prohibited.<sup>19</sup>

- (50) a. \*C-[dor] & C-[closed, open]: Segments with C-place[dor] & C-manner[open] & C-manner[closed] are disallowed.
- b. \*V-[cor] & C-[closed, open]: Segments with V-place[cor] & C-manner[open] & C-manner[closed] are disallowed.
- c. DEPLINK C-[lab] & \*C-[closed, open]: Do not associate C-place[lab] to a segment that has C-manner[closed, open] on the surface.
- d. DEPLINK C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub>: For each NC sequence sharing C-manner[open], do not associate C-place[dor] to a segment that did not have it underlyingly.

Tableau (51) exemplifies NPA in the word *fiŋga:l* ‘coffee cup’. Candidates (a) and (b) are ruled out by OCP C-manner[F] and L-ALIGN C-[dor]/NC. The assimilating output (51c) emerges as optimal, even though it violates DEPLINK and the markedness constraint against non-contrastive dorsal nasals.

<sup>19</sup> To eliminate a target nasal //m// in the input, ALIGNMENT must be outranked by two other conjoined constraints against the linkage of C-place[dor] and V-place[cor] to a segment that has C-place[lab].

(51) OCP C-manner[F], L-ALIGN C-[dor]/NC >> \*C-[dor] & C-[closed, open], DEP LINK C-[dor]

	//finga:l //	OCP C-manner[F]	L-ALIGN C-[dor]/NC	*C-[dor] & C-[closed, open]	DEPLINK C-[dor]
a.		*!			
b.			*!		
c.				*	*

The ranking in (52) explains why C-place[dor] assimilation fails if the NPA trigger is a velar fricative /x, ɣ/. The high cost of violating DEPLINK C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub> would always generate an optimal output that violates ALIGNMENT.

(52) OCP C-manner[F], DEPLINK C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub> >> L-ALIGN C-[dor]/NC >> \*C-[dor] & C-[closed, open], DEPLINK α-place[F]

The coalescence of a coronal stop with a palatoalveolar fricative into an affricate is motivated by the feature-spreading imperative in (53a). The C<sub>1</sub>C<sub>2</sub> sequence to which this constraint applies shares V-place[cor] of the rightmost segment as in (39c) above. Once the alignment imperative applies, the output is doomed to acquire an additional C-manner[closed] feature, turning it into a sonorant. This scenario leads to violation of the conjoined constraint in (53b).

- (53) a. R-ALIGN C-[closed]/C<sub>[cor]</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share a feature [cor], then the right edge of C-manner[closed] must be aligned to the right edge of the sequence.
- b. DEPLINK C-[closed] & \*C-[open]: Do not associate C-manner[closed] to a segment that has C-manner[open] on the surface.

In the following tableau, (54a) is ruled out by OCP [cor]. An OCP repair by sharing the leftmost C-place[cor] feature incurs a fatal violation of DEPLINK [cor]/C<sub>2</sub> (54b). Candidate (d) shares the rightmost place node, and satisfies the R-ALIGN C-[closed] requirement. However, the resulting sonorant [ʔ] incurs a violation of DEPLINK C-[closed] & \*C-[open]. This is repaired by feature deletion in the optimal output (54e).

(54) OCP [cor], DEPLINK [cor]/C<sub>2</sub>, R-ALIGN C-[closed]/C<sub>[cor]</sub>C<sub>[cor]</sub>, DEPLINK C-[closed] & \*C-[open] >> DEPLINK [cor]/C<sub>1</sub>, DEPLINK C-[closed], MAX C-[open]

	//mit-ʃai:l //	OCP [cor]	DEPLINK [cor]/C <sub>2</sub>	R-ALIGN C-[closed]/C <sub>[cor]</sub> C <sub>[cor]</sub>	DEPLINK C-[closed] & *C-[open]	DEPLINK [cor]/C <sub>1</sub>	DEPLINK C-[closed]	MAX C-[open]
a.		*!						
b.			*!	*!				
c.				*!		*		
d.					*!	*	*	
e.						*	*	*

## 2. LOCAL PLACE ASSIMILATION

Next we account for the assimilation of the emphatic feature V-place[dor] from /t̤, d̤, s̤, z̤, r̤/ to a homorganic //t, d, s, z, r//. The alignment imperative, formulated in (55a), demands that the C<sub>1</sub>C<sub>2</sub> domain shares C-place[cor]. Tableau (56) exemplifies spreading of V-place[dor] from emphatic /s̤/ to an adjacent //d//. The target in the optimal output (56c) surfaces with emphasis and violates DEPLINK V-[dor]. Other candidates that violate the high-ranked OCP or ALIGNMENT are ruled out.

(55) a. L-ALIGN V-[dor]/C<sub>[cor]</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-place[cor], then the left edge of V-place[dor] must be aligned to the left edge of the sequence.

b. DEPLINK V-[dor]: Do not associate V-place[dor] to a segment that did not have it underlyingly.

(56) OCP C-[cor], L-ALIGN V-[dor]/C<sub>[cor]</sub>C<sub>[cor]</sub> >> DEPLINK V-[dor]

	//wɑ:d s̤ɑ:jiŋ //	OCP C-[cor]	L-ALIGN V-[dor]/ C <sub>[cor]</sub> C <sub>[cor]</sub>	DEPLINK V-[dor]
a.		*!		
b.			*!	
c.				*

Following the same analytical proposal, the total assimilation of a coronal stop to a labial or velar stop requires the alignment constraints in (57a–b). Here spreading applies only to C<sub>1</sub>C<sub>2</sub> sequences sharing C-manner[closed] in the phonological phrase domain. We also need the high-ranked conjoined constraint DEPLINK C-[dor] & \*C-[cor] in (40c) to avoid segments with multiple C-place features.

(57) a. L-ALIGN C-[dor]/C<sub>[cl]</sub>C<sub>[cl]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-manner[closed], then the left edge of C-place[dor] must be aligned to the left edge of the sequence.



- b. L-ALIGN C-[lab]/C<sub>[cl]</sub>C<sub>[cl]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-manner[closed], then the left edge of C-place[lab] must be aligned to the left edge of the sequence.

In the following tableau, which illustrates the assimilation of //t// to a velar stop /g/, candidate (b) falls victim to L-ALIGN C-[dor]/C<sub>[cl]</sub>C<sub>[cl]</sub>. And although both (58c) and (58d) undergo spreading, only the latter avoids the fatal violation of DEPLINK C-[dor] & \*C-[cor], emerging as the optimal output.

- (58) OCP C-manner[F], L-ALIGN C-[dor]/C<sub>[cl]</sub>C<sub>[cl]</sub>, DEPLINK C-[dor] & \*C-[cor] >> MAX C-[cor], NOGEM

	//baʕat kita:b //	OCP C-manner[F]	L-ALIGN C-[dor] /C <sub>[cl]</sub> C <sub>[cl]</sub>	DEPLINK C-[dor] & *C-[cor]	MAX C-[cor]	NOGEM
a.		*!				
b.			*!			
c.				*!		
d.					*	*

Two alignment imperatives in (59a–b) account for assimilation of non-coronal stops to their homorganic fricatives. The domain is conditioned by a shared C-place[lab] for //b// → /f, v/ and by a shared C-place[dor] for //k, g// → /x, ɣ/. The leftward direction of alignment guarantees that the reverse order of segments (fricative + stop) does not trigger the assimilation. The ranking of relevant constraints is provided in (59c).

- (59) a. L-ALIGN C-[open]/C<sub>[lab]</sub>C<sub>[lab]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-place[lab], then the left edge of C-manner[open] must be aligned to the left edge of the sequence.
- b. L-ALIGN C-[open]/C<sub>[dor]</sub>C<sub>[dor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-place[dor], then the left edge of C-manner[open] must be aligned to the left edge of the sequence.
- c. OCP C-[lab], L-ALIGN C-[open]/C<sub>[lab]</sub>C<sub>[lab]</sub>, L-ALIGN C-[open]/C<sub>[dor]</sub>C<sub>[dor]</sub>, DEPLINK C-[open] & \*C-[closed] >> DEPLINK C-[open], MAX C-[closed], NOGEM

Finally, the assimilation of //h// is motivated by a high-ranking OCP C-[open]. The constraints in (60a–b) demand right or left alignment of C-place[dor] and V-manner[open] from /x, ɣ/ and /ħ, ʕ/ respectively, where the domain is conditioned by shared C-manner[open]. Since the process targets only //h// among the segments bearing C-manner[open], other potential targets must not be able to combine the aligned feature with C-manner[closed], V-manner[open], or with any place feature ( $\alpha$ -place[F] for short). In OT terms, (60a) is ranked lower than the conjoined constraints in (60c–e) and lower than MAX constraints against feature deletion (not included in the ranking because of the irrelevant target).

- (60) a. L/R-ALIGN C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-manner[open], then the left/right edge of C-place[dor] must be aligned to the left/right edge of the sequence.
- b. L/R-ALIGN V-[open]/C<sub>[op]</sub>C<sub>[op]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-manner[open], then the left/right edge of V-manner[open] must be aligned to the left/right edge of the sequence.
- c. DEPLINK C-[dor] & \* $\alpha$ -place[F]: Do not associate C-place[dor] to a segment that has  $\alpha$ -place[F] on the surface.
- d. DEPLINK C-[dor] & \*V-[open]: Do not associate C-place[dor] to a segment that has V-manner[open] on the surface.
- e. DEPLINK C-[dor] & \*C-[closed]: Do not associate C-place[dor] to a segment that has C-manner[closed] on the surface.

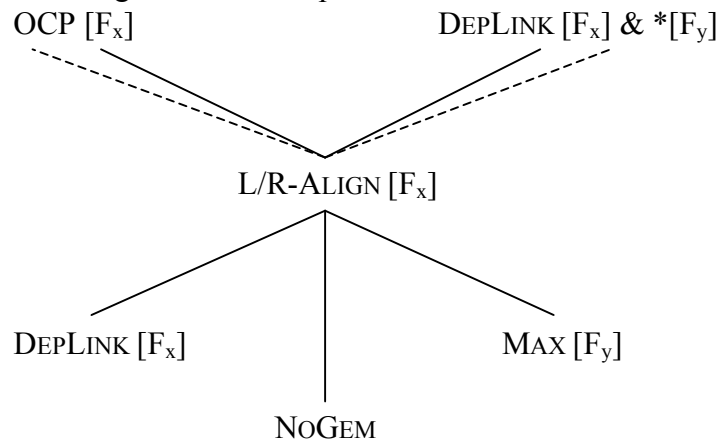
In Tableau (61), a potential output (b) avoids OCP violations, but it fails to satisfy the high-ranked alignment constraint. The optimal output (61c) violates only low-ranked DEPLINK C-[dor] and NOGEM. A tableau for the triggers /ħ, ʕ/ would involve similar constraints that replace C-place[dor] with V-manner[open]. With the lack of place features involved, this ranking is not presented here.

(61) OCP C-[open] >>> L/R-ALIGN C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub> >>> DEPLINK C-[dor], NOGEM

	//ʃabah xa:lu //	OCP C-[open]	L/R-ALIGN C-[dor]/C <sub>[op]</sub> C <sub>[op]</sub>	DEPLINK C-[dor]	NO GEM
a.		*!			
b.			*!		
c.				*	*

To recapitulate, Cairene local place assimilation covers a wide range of processes. In OT, the rankings follow a basic pattern where OCP and some conjoined constraints dominate feature alignment constraints, which in turn dominate faithfulness to the input (DEPLINK and MAX) and NOGEM. The diagram in (62) schematically depicts this pattern, but it is by no means an exhaustive picture of LPA in Cairene Arabic. Dashed lines mean that occasionally some of these constraints are unranked.

(62) Constraint rankings for CA local place assimilation



### 2.3 Local Place Assimilation in Baghdadi Arabic

This current section investigates processes of local place assimilation in Baghdadi Arabic, which involve most of the consonant inventory. Although LPA appears to be less diverse in BA compared to CA, it covers the same parameters: unidirectional vs. reciprocal, total vs. partial, and word level vs. phrase level. Various grammars of BA explore aspects of LPA, but the accounts are far from complete. In an attempt to fill this gap, I have generated data from a number of secondary sources and conducted a similar but small-scale study using a single speaker, a 27 year-old female native of Baghdad with a university background. The data was then categorized and analyzed in line with other segmental processes in the language.

The remainder of this section is organized as follows. Sections 2.3.1 and 2.3.2 present data and descriptions of morpheme-specific and general LPA as well as other place-related assimilations, and infer some generalizations on the natural classes of participating segments. Section 2.3.3 gives an account of an interesting interaction between vowel epenthesis and local assimilation in BA. Section 2.3.4 justifies PSM feature specifications for all relevant segments, and then provides autosegmental representations for their interactions. And section 2.3.5 proposes a formulation of the assimilation patterns within Optimality Theory.

#### 2.3.1 Morpheme-Specific Assimilations in BA

##### 2.3.1.1 Assimilation of the Definite Article *l-*

As in all other dialects of Arabic, the definite article in BA has two forms. The form /l/ occurs with nouns and adjectives that start with the following consonants /b, p, m, f, k, g, x, ʕ, q, ħ, ʕ, ʔ, h/ and the semi-vowels /w, j/ (63a). Unlike CA, the article also appears unassimilated, as /l/, before the velar/uvular stops /k, g, q/. Such is also the case before a cluster the first consonant of which is one of the above. In this position, a default epenthetic vowel /i/ is inserted before the cluster (Erwin 1963:214, Majdi 1988:205), as shown in (63b). The glottal stop /ʔ/ may be treated as epenthetic where it optionally deletes before the definite article (McCarthy and Raffouli 1964:34).

(63) The “moon letters” in simple and complex onsets <sup>20</sup>

a.	<i>l-beet</i>	‘the house’	<i>l-pa:ja</i>	‘the step’
	<i>l-mooz</i>	‘the bananas’	<i>l-faʕʕir</i>	‘the dawn’
	<i>l-katib</i>	‘the clerk’	<i>l-ʕuʕi:n</i>	‘the cotton’
	<i>l-qisim</i>	‘the part’	<i>l-hazal</i>	‘the joking’
	<i>l-xeel</i>	‘the horses’	<i>l-yada</i>	‘the lunch’
	<i>l-ħali:b</i>	‘the milk’	<i>l-ʕinab</i>	‘the grapes’
	<i>l-wakit</i>	‘the time’	<i>l-joom</i>	‘the day’
	<i>l-ʔakil /l-akil</i>	‘the food’	<i>l-ʔisim /l-isim</i>	‘the name’

<sup>20</sup> Note that BA allows initial consonant clusters, and vowel epenthesis is only optional. See §2.3.3.1.

b.	<i>l-ibla:m</i>	‘the rowboats’	<i>l-ibnajja</i>	‘the girl’
	<i>l-ibju:t</i>	‘the houses’	<i>l-iflu:s</i>	‘the money’
	<i>l-iqma:f</i>	‘the fabric’	<i>l-imra:ja</i>	‘the mirror’

On the other hand, the article is assimilated to word-initial coronal consonants /t, t̤, d, s, s̤, z, θ, ð, ð̤, r, ʃ, tʃ, ʧ, l, (l̤), n/, and the output is a false geminate. McCarthy and Raffouli (1964:33) note that some educated speakers avoid the assimilation of /ʧ/ in formal contexts, which is the situation in Standard Arabic.<sup>21</sup> In any case, assimilation applies obligatorily to the definite article before native and borrowed words alike, as shown in (64a). When prefixed to a cluster-initial word in which the first consonant is one of the above, the article is realized either as /l/ followed by epenthetic /i/ (64b) or as assimilated followed by epenthetic /i/—optionally for most clusters (64c), but only the former in certain morphological classes (Erwin 1963:215–6).

(64) The “sun letters” in simple and complex onsets

a.	<i>t-timan</i>	‘the rice’	<i>t̤-t̤oʕba</i>	‘the ball’
	<i>s-sahal</i>	‘the easy’	<i>s̤-s̤u:r̤a</i>	‘the picture’
	<i>d-daris</i>	‘the lesson’	<i>d-da:ma</i>	‘the checkers’
	<i>z-zibid</i>	‘the butter’	<i>ʃ-ʃahar</i>	‘the month’
	<i>θ-θoob</i>	‘the shirt’	<i>ð-ðahab</i>	‘the gold’
	<i>ð̤-ð̤a:b̤u:t̤</i>	‘the officer’	<i>r-rukka:b</i>	‘the passengers’
	<i>n-nar</i>	‘the fire’	<i>l-leela</i>	‘the night’
	<i>tʃ-tʃa:ku:tʃ</i>	‘the hammer’	<i>ʧ-ʧu:n̤a</i>	‘the suitcase’
b.	<i>l-ittifa:q</i>	‘the agreement’	<i>l-iʧtima:ʕ</i>	‘the meeting’
	<i>l-istiʕma:l</i>	‘the use’	<i>l-iskamli</i>	‘the chair’
c.	<i>l-iʧba:l</i>	‘the mountains’	~ <i>ʧ-ʧiba:l</i>	‘the mountains’
	<i>l-isni:n</i>	‘the years’	~ <i>s-sini:n</i>	‘the years’
	<i>l-it̤bu:l</i>	‘the drums’	~ <i>t̤-t̤u:bu:l</i>	‘the drums’

The literature is ambiguous as to the status of the lateral segment /l/, the reason being that the output of *l*-assimilation is always a false geminate. However, when prefixed to a word beginning with a consonant cluster of which the first consonant is /l/, e.g., *l̤a:f* ‘nice MPL’, the option of inserting an epenthetic vowel /i/ after the article does not hold in \**l̤il̤a:f*, which confirms that /l/ and, as matter of course, its emphatic cognate /l̤/ must be grouped with the assimilating coronals.

The process is heavily morphologized: only //l// of the definite article is affected. This becomes clear if we consider identical consonant sequences that fail to undergo assimilation in other morphemes, such as those in (65). Exceptions are confined to cases of the sonorant triggers /n, r/ (see §2.3.2.1).

<sup>21</sup> Kambuziya (2007) claims that the coronal affricate consonant /ʧ/ does not take part in the assimilation process in Standard Arabic because it derives historically from velar /g/.

## (65) Non-assimilating /l/ morpheme-internally

<i>ʔaltʔaf</i>	‘nicer’	<i>ʔaltʔum</i>	‘I slap my face’
<i>ʔalday</i>	‘I sting’	<i>maʔlθʔum</i>	‘strung up’
<i>lsa:n</i>	‘tongue’	<i>ʔilza:mi</i>	‘compulsory’
<i>lɕa:m</i>	‘bridle’	<i>malʔu:m</i>	‘stricken’

2.3.1.2 Assimilation of *t*- Prefixes

Two homophonous prefixes of Baghdadi undergo total assimilation, the detransitivizing verbal prefix *t*- of measure V and VI verbs (or their participles) and the imperfect verb subject prefixes involving *t*- (3FS, 2MS, 2FS, 2PL). Both types of prefixes surface as /t/ before the following classes of consonants: sonorants /r, l, l̥, n/, labials /b, p, f, m/, and all consonants with a back articulation /k, g, q, x, ɣ, ħ, ʕ, ʔ, h/. Examples are given in (66a–b).

(66) Non-assimilating prefixal *t*-

a.	<i>t-baddal</i>	‘he changed’	<i>t-lawwan</i>	‘it was colored’
	<i>t-karrar</i>	‘it repeated’	<i>t-gaddam</i>	‘he advanced’
	<i>t-qabbal</i>	‘he accepted’	<i>t-haɕɕam</i>	‘he acted hostilely’
b.	<i>t-ri:d</i>	‘you MS want’	<i>t-qa:rni:n</i>	‘you FS compare’
	<i>t-ɣusʕʔum</i>	‘you PL cut’	<i>t-ɣaʕʕʔum</i>	‘you PL finish’

The prefixal *t*- undergoes total assimilation in contact with /t, t̥, d, s, s̥, z, θ, ð, ð̥, ʃ, ʧ, ɕ/ (Altoma 1969:17, Ghalib 1984:37–9), which constitute the non-sonorant subclass of the “sun letters” above. Unlike CA, the velar/uvular stops /k, g, q/ are not triggers. The process results in a false geminate, as shown in (67a–b); and assimilation to the triggers /t, t̥, d/ may be accounted for independently as the result of voicing and/or emphatic assimilation. One should note that the process is clearly morpheme-specific, and may not apply within or across other morphemes.

(67) Assimilation of prefixal *t*- to adjacent coronals

a.	<i>t-tikal</i>	‘he relied’	<i>mit̥-tʔalʔaɕ</i>	‘divorced MS’
	<i>d-daxxal</i>	‘he interfered’	<i>d-dammur</i>	‘it was ruined’
	<i>{s}-sa:baq</i>	‘he raced’	<i>mi{s}-sa:maħ</i>	‘forgiving MS’
	<i>{s̥}-s̥aħħaħ</i>	‘it was corrected’	<i>{s̥}-s̥a:lʔaħ</i>	‘he reconciled’
	<i>{z}-zaħlig</i>	‘he slipped’	<i>mi{z}-zawɕa</i>	‘married FS’
	<i>{θ}-θa:wab</i>	‘he yawned’	<i>{θ}-θabbat</i>	‘he verified’
	<i>{ð}-ðammar</i>	‘he grumbled’	<i>{ð̥}-ð̥arɕar</i>	‘he was harmed’
	<i>{ʃ}-ʃammas</i>	‘he sunned’	<i>{ʃ}-ʃatʔʔaf</i>	‘he washed himself’
	<i>{ʧ}-ʧa:lab</i>	‘he rushed upon’	<i>{ɕ}-ɕa:hal</i>	‘he ignored’
b.	<i>{t̥}-t̥i:b</i>	‘you MS get well’	<i>{d}-darris</i>	‘you MS teach’
	<i>{s}-sawwi</i>	‘you MS do’	<i>{z}-zajjan</i>	‘you MS shave’
	<i>{s̥}-s̥i:ru:n</i>	‘you PL become’	<i>{ʃ}-ʃi:lu:n</i>	‘you PL carry’

{θ}-θi:ri:n	‘you FS arouse’	{ð}-ðakri:n	‘you FS remind’
{ðʕ}-ðʕi:nn	‘she supposes’	{ʕ}-ʕahhaz	‘she equips’

### 2.3.2 General Assimilations in BA

#### 2.3.2.1 Total Assimilation of Sonorants

The sonorants //n, l, l̥, r// may totally and regressively assimilate to each other across morpheme and word boundaries. Let’s consider all potential combinations of adjacent sonorants in BA. First, //n// undergoes total regressive assimilation to a following /l, l̥, r/ (note that /l̥/ never occurs word-initially (Rahim 1980:206)). Within the phonological word, the detransitivizing *n-* of measure VII verbs assimilates to /l, l̥, r/-initial verbs, as shown in (68a) (Malaika 1963:5). The process applies also within the phrase domain (68b).

#### (68) Regressive assimilation of //n// to /l, l̥, r/ in BA

a.	//man-ru:ḥ //	→	marru:ḥ	‘we do not go’
	//jin-radd //	→	jirradd	‘it is needed’
	//ʔin-rabbi //	→	ʔirrabbi	‘we educate’
	//ʔin-rukab //	→	ʔirrukab	‘it was ridden’
	//ʔin-laʕbak //	→	ʔillaʕbak	‘we play with you’
	//ʔin-luðʕam //	→	ʔilluðʕam	‘it was threaded’
b.	//min ra:sha //	→	mir ra:sha	‘of her head’
	//min laḥmi //	→	mil laḥmi	‘of my flesh’
	//ʔa:n la //	→	ʔa:l la	‘he had’

The total assimilation of //l, l̥// to a following /n/ occurs only within the phonological word, as exemplified in (69a) (Erwin 1963:37, Ghalib 1984:40). And it has the same effect as *l*-assimilation to /n/ (§2.3.1.1). On the other hand, the total assimilation of //l, l̥// to a following /r/ is active in the phrase domain (69b). Finally one must note that, as in CA, //r// does not totally assimilate to a following /n/ or /l, l̥/.

#### (69) Regressive assimilation of //l, l̥// to /n, r/

a.	UR	SR		alternation
	//baddal-na //	→	baddanna	‘we changed’
	//ma:l-na //	→	ma:nna	‘ours’
	//ʔil-na //	→	ʔinna	‘to us’
	//ʔakal-na //	→	ʔakanna	‘we ate’
				<i>baddal-u</i> ‘they changed’
				<i>ma:l-hum</i> ‘theirs’
				<i>ʔil-ha</i> ‘to her’
				<i>ʔakal-tum</i> ‘you PL ate’
b.	//tiʕtiyaḻ raqqa:sʕa //	→	tiʕtiyaḻ raqqa:sʕa	‘she works as belly dander’
	//staʕmal raff //	→	staʕmar raff	‘he used a shelf’
	//ʕummal ru:s //	→	ʕummar ru:s	‘Russian workers’

Occasionally, //n// and //l// undergo total assimilation before the alveolar stops /t, d/ (Abu-Haidar 2006:225). Although alternations with non-assimilating forms do exist (70), these cases seem to be lexicalized (see Erwin 1963:97, fn.1). Evidence comes from other words where the same sequences do not assimilate, such as *?antaɖʒ* ‘he produced’ and *?alday* ‘I sting’.

(70) Lexicalized cases of //n, l// to /t/ or /d/ assimilation

<i>?itti</i>	‘you FS’	~	<i>?inti</i>	‘you FS’
<i>bitti</i>	‘my daughter’	<u><i>but</i></u>	<i>binit</i>	‘daughter’
<i>gittu</i>	‘you PL said’	<u><i>but</i></u>	<i>gulit-ha</i>	‘I told it’
<i>ʔadha</i>	‘she has’	<u><i>but</i></u>	<i>ʔindi</i>	‘I have’

### 2.3.2.2 Nasal Place Assimilation (Partial)

The nasal //n// assimilates to the place of articulation of a following labial stop /b, p, m/, and the output is a labial nasal /m/ (Malaika 1963:6). In the case of a trigger /m/, NPA coincidentally results in a false geminate, as will be explained in §2.3.3. The left-hand column in (71a) shows obligatory NPA in the word domain (in nouns and adjectives), and the alternations in the right-hand column provide evidence for underlying //n// in other contexts (cf. al-Qahtani 2004:30–3). (71b) exemplifies the same obligatory NPA in verbs, which is either stem internal (in imperfect verbs) or across morpheme boundaries (in measure VII verbs with a /b/- or /m/-initial root preceded by the detransitivizing prefix *n-*). And (71c) exemplifies optional NPA in the phrase domain, e.g., when the preposition *min* ‘of’ is followed by a trigger-initial word.

(71) Partial place assimilation of //n// to a following labial stop

a.	<i>dambu:s</i>	‘pin’		<i>dana:bi:s</i>	‘pins’
	<i>sumbula</i>	‘ear (of grain)’		<i>sana:bi:l</i>	‘ears (of grain)’
	<i>qumbula</i>	‘bomb’		<i>qana:bi:l</i>	‘bombs’
	<i>zambur</i>	‘wasp’		<i>zna:bir</i>	‘wasps’
	<i>?umbu:b</i>	‘tube’		<i>?ana:bi:b</i>	‘tubes’
	<i>ʔambar</i>	‘ward’		<i>ʔana:bir</i>	‘wards’
	<i>?ambal</i>	‘more noble’		<i>nabi:l</i>	‘noble’
b.	<i>m-ba:ʔ</i>	‘it was sold’	<u><i>but</i></u>	<i>n-katab</i>	‘it was written’
	<i>m-ba:g</i>	‘stolen’	—	—	—
	<i>m-muxaʔ</i>	‘it is blown (nose)’	—	—	—
	<i>m-murad</i>	‘it is crushed’	—	—	—
	<i>dam-mu:t</i>	‘we’re dying’	<u><i>but</i></u>	<i>dan-ʔi:ʃ</i>	‘we’re living’
	<i>dam-mi:l</i>	‘we’re bending’	—	—	—
c.	//wain ba:ba//	→	<i>wee{m}ba:ba</i>	‘where is daddy?’	
	//θnain patu//	→	<i>θnee{m}patu</i>	‘two blankets’	
	//min mudda//	→	<i>mi{m}udda</i>	‘some time ago’	



Before a labiodental fricative /f/, assimilation of //n// creates a labiodental nasal [ɱ], which is an allophone of the contrastive phoneme /m/ (see §2.3.4.1). Assimilation is obligatory in the word domain (72a–b) and optional in the phrase domain (72c).

(72) Partial place assimilation of //n// to a following labiodental fricative

a.	<i>ʕu[ɱ]f</i>	‘violence’		<i>ʕani:f</i>	‘violent’
	<i>gu[ɱ]fið</i>	‘hedgehog’		<i>gana:fið</i>	‘hedgehogs’
	<i>?a-[ɱ]faʕ</i>	‘more useful’		<i>na:fiʕ</i>	‘useful’
b.	<i>ju-[ɱ]fuð<sup>ʕ</sup></i>	‘he shakes out’		<i>ɲuʔað<sup>ʕ</sup></i>	‘he shook out’
	<i>ji-[ɱ]fid</i>	‘he escapes’		<i>nafad</i>	‘he escaped’
	<i>[ɱ]-fiɕar</i>	‘it exploded’	<i>but</i>	<i>?in-ʕiraf</i>	‘it was discovered’
	<i>[ɱ]-fitaḥ</i>	‘it was opened’	—	—	—
	<i>[ɱ]-fuʕaʕ</i>	‘he was separated’	—	—	—
c.	<i>//min faɕwa //</i>	→	<i>mi{[ɱ]}faɕwa</i>	‘from a gap’	
	<i>//wain fa:di //</i>	→	<i>wee{[ɱ]}fa:di</i>	‘where is Fādi?’	

The alveolar nasal //n// assimilates in place to the velar and uvular stops (see Rahim 1980:244). The output is the non-contrastive segment /ŋ/—more specifically the velar allophone [ŋ] before /k, g/ and the uvular allophone [ɴ] before /q/. The assimilation always applies in the phonological word domain (in nouns, adjectives, and verbs), as exemplified in (73a–b). However, it may or may not apply across word boundaries (73c). No assimilation of //n// to a following velar fricatives /x, ɣ/ has been noted.

(73) Partial place assimilation of //n// to a following velar/uvular stop

a.	<i>ʕaŋkabu:t</i>	‘spider’		<i>ʕana:kib</i>	‘spiders’
	<i>baŋg</i>	‘bank’		<i>binu:g</i>	‘banks’
	<i>tunɣa</i>	‘clay jug’		<i>tunag</i>	‘clay jugs’
	<i>?aŋgas</i>	‘more filthy’		<i>na:gis</i>	‘filthy’
	<i>ma[ɴ]qal</i>	‘brazier’		<i>mana:qil</i>	‘braziers’
	<i>?a[ɴ]qas<sup>ʕ</sup></i>	‘more inferior’		<i>ɲa:qis<sup>ʕ</sup></i>	‘inferior’
b.	<i>ji-ŋkiθ</i>	‘he violates’		<i>nikaθ</i>	‘he violated’
	<i>ji-ŋgar</i>	‘he pecks’		<i>nagar</i>	‘he pecked’
	<i>ji-[ɴ]qal</i>	‘he transports’		<i>naqal</i>	‘he transported’
	<i>ŋ-kisar</i>	‘it was broken’	<i>but</i>	<i>n-simaʕ</i>	‘he was heard’
	<i>ŋ-kitab</i>	‘it was written’	—	—	—
	<i>ŋ-giḥam</i>	‘it was overcome’	—	—	—
	<i>[ɴ]-qihar</i>	‘he was annoyed’	—	—	—
c.	<i>//min kita:b //</i>	→	<i>mi{ŋ}kita:b</i>	‘from a book’	
	<i>//sa:kin gabur //</i>	→	<i>sa:ki{ŋ}gabur</i>	‘living in a grave’	
	<i>//maka:n qafiz //</i>	→	<i>maka:{[ɴ]}qafiz</i>	‘jumping place’	

Lastly, //n// assimilates in place to the left of palatoalveolar //ʃ, tʃ, ʒ// in the word and phrase domains, as exemplified in (74a–c). For perceptual reasons, this assimilation is difficult to detect. However, close examination indicates a clear effect on the alveolar target //n//, which is realized as a palatoalveolar nasal /ɲ/.

(74) Partial place assimilation of //n// to a following palatoalveolar

a.	<i>ʔaɲʃatʕ</i>	‘more energetic’	<i>naʃi:tʕ</i>	‘energetic’
	<i>miɲʃa:r</i>	‘saw’	<i>niʃar</i>	‘he sawed’
	<i>xaiɲʒar</i>	‘dagger’	<i>xana:ʒir</i>	‘daggers’
	<i>ħaiɲʒara</i>	‘larynx’	<i>ħana:ʒir</i>	‘larynxes’
b.	<i>ji-ɲʃaf</i>	‘it dries’	<i>niʃaf</i>	‘he dried’
	<i>ji-ɲʒaħ</i>	‘he succeeds’	<i>niʒaħ</i>	‘he succeeded’
	<i>ji-ɲʒa</i>	‘he escapes’	<i>niʒa</i>	‘he escaped’
	<i>ɲ-ʃarab</i>	‘it was drunk’	—	
	<i>ɲ-tʃifa</i>	‘it was turned over’	—	
	<i>ɲ-ʒimaʕ</i>	‘it was collected’	—	
c.	// <i>min ʃarr</i> //	→	<i>mi{ɲ}ʃarr</i>	‘from the evil of’
	// <i>ħasan tʃibir</i> //	→	<i>ħasa{ɲ}tʃibir</i>	‘Hasan is big’
	// <i>sʕaħan ʒa:r-i</i> //	→	<i>sʕaħa{ɲ}ʒa:ri</i>	‘my neighbor’s plate’

### 2.3.2.3 Coronal Place Assimilation

Coronal place assimilation, whereby adjacent coronal consonants must agree in place of articulation, is also found in BA. This subsection examines three subtypes of CPA attested for BA coronals. The first process is the merge of a coronal stop //t, tʕ, d// with a following palatoalveolar fricative //ʃ// in the word or phrase domain to form an affricate /tʃ/ (75). The output is the result of coalescence rather than partial or total assimilation and, unlike CA, it surfaces identically to a contrastive segment in the BA consonant inventory.

(75) Merge of //t, tʕ, d// with a following palatoalveolar fricative //ʃ//

a.	// <i>jit-ʃa:lab</i> //	→	<i>jitʃa:lab</i>	‘he grappled with’
	// <i>ʔatʃa:n</i> //	→	<i>ʔatʃa:n</i>	‘thirsty’
	// <i>batʃa</i> //	→	<i>batʃa</i>	‘his knocking down’
b.	// <i>ħabbait ʃikla</i> //	→	<i>ħabbeetʃikla</i>	‘I liked her appearance’
	// <i>walad ʃahm</i> //	→	<i>walatʃahim</i>	‘a noble boy’
	// <i>xa:lid ʃawqi</i> //	→	<i>xa:litʃawqi</i>	(personal name)
	// <i>xiʕatʕ ʃakar</i> //	→	<i>xiʕatʃakar</i>	‘he mixed sugar’

There is a general tendency in BA toward the assimilation of a stop to a following homorganic fricative (Blanc 1964:53). One case is the regressive partial assimilation of an affricate //tʃ, ʒ// to a following coronal fricative, resulting in a palatoalveolar /ʃ/

or /ʒ/. As shown in (76a), the process seems to apply only within pre-vocalic onset clusters. The reverse direction, fricative plus stop, is also attested in the optional total assimilation of the dentals //θ, ð, ðʕ// to a following /t/, exemplified in (76b).<sup>22</sup>

## (76) Assimilation of stops and homorganic fricatives

a.	//θa:θ //	→	ʃθa:θ	‘fat PL’
	//θu:r //	→	ʒðu:r	‘roots’
	//ʔaθðib //	→	ʔaʒðib	‘I attract’
	//ʔaθza:ʕ //	→	ʔaʒza:ʕ	‘parts’
	//ʔaθðab //	→	ʔaʒðab	‘more untruthful’
b.	//biʃaθ-ta //	→	biʃa{t}ta	‘I sent him’
	//ʔaxað-ta //	→	ʔaxa{t}ta	‘I took him’
	//ʕiraðʕ-ta //	→	ʕira{t}ta	‘I presented it’

Finally, the non-emphatic coronals assimilate regressively to adjacent emphatics in the phrase domain. That is to say, in a C<sub>1</sub>C<sub>2</sub> sequence where C<sub>2</sub> is an emphatic /tʕ, sʕ, ðʕ/, a plain coronal /θ, ð, t, d, s, z, l/ will turn into its emphatic counterpart, as shown in (77a–b). The changes may involve further regressive voicing or de-voicing assimilation, possibly resulting in non-contrastive emphatics like /dʕ, zʕ, θʕ/. And despite the apparent connection to emphasis spread (see §3.3.2.2), these assimilations are treated under LPA because they apply in a different domain and require strict adjacency of trigger and target.

## (77) Assimilation of plain coronals to adjacent emphatics

a.	//miʃait tʕari:q //	→	miʃeetʕ tʕari:q	‘I walked a road’
	//ʔaħmad tʕwi:l //	→	ʔaħmatʕ tʕwi:l	‘Ahmed is tall’
	//la:biʕ sʕandal //	→	la:biʕʕ sʕaṇḍal	‘he’s wearing sandals’
	//θa:liθ ðʕaif //	→	θa:liðʕ ðʕeef	‘the third guest’
	//naffað ðʕulʕm //	→	naffaðʕ ðʕulʕm	‘he executed injustice’
b.	//sa:diʕ tʕa:biq //	→	sa:diʕʕ tʕa:biq	‘the sixth floor’
	//naba:t ðʕaxm //	→	naba:tʕ ðʕaxim	‘a huge plant’
	//θa:wbat sʕaħħ //	→	θa:wbatʕ sʕaħħ	‘she answered correctly’

## 2.3.2.4 Non-Coronal Place Assimilation

In connection with Baghdadi’s tendency to assimilate a stop to a following homorganic fricative, Blanc (1964) mentions an optional total assimilation of a labial stop //p, b// to a homorganic labial fricative /f/ within words and across word boundaries, exemplified in (78). However, if a fricative is followed by a stop, no assimilation

<sup>22</sup> I presume that coronal stops assimilate to homorganic spirants as well, but no examples have been given to support this beyond the morphologized assimilations in §2.3.1.2 above.

takes place. I should note that other cases of non-coronal place assimilation could not be synchronically verified in BA.<sup>23</sup>

(78) Assimilation of labial stops to their homorganic fricatives

//b// + <i>faras</i> //	→	{f} <i>faras</i>	‘with a horse’
//b// + <i>faħis</i> <sup>f</sup> //	→	{f} <i>faħis</i> <sup>f</sup>	‘in a checkup’
//kita:b <i>fathi</i> //	→	<i>kita:</i> {f} <i>fathi</i>	‘Fathi’s book’

### 2.3.3 Opaque Interaction of Epenthesis and Assimilation in BA

This section examines epenthesis in Baghdadi Arabic and its interaction with total and partial assimilations at the word and phrase levels. I start with a brief discussion of vowel epenthesis within various strings of consonant clusters, then I discuss the lack of epenthesis within clusters that undergo total assimilation—resulting in false geminates—or partial assimilation.

#### 2.3.3.1 Epenthesis in BA

Final (underlying) consonant clusters in BA are broken up by an epenthetic vowel, which surfaces as /i, u, a/ depending on the quality of the surrounding consonants (see §4.3.1 for a detailed discussion). Epenthesis takes place when the cluster is followed by a pause, but never when it is followed by a vowel-initial morpheme (79a). If a CC cluster is followed by a morpheme beginning with a single consonant, epenthesis occurs between the first two members of the new sequence (CiCC), as shown in (79b) (Blanc 1964:56, Altoma 1969:19).

(79) Epenthesis/non-epenthesis in word-final consonant clusters

a.	<i>ǧaʕub</i>	‘heart’	<i>ǧaʕb-a</i>	‘his heart’
	<i>?ibin</i>	‘son’	<i>?ibn-ak</i>	‘your MS son’
b.	<i>ǧaʕub-ha</i>	‘her heart’	<i>ǧaʕub-hum</i>	‘their heart’
	<i>?ibin-na</i>	‘our son’	<i>?ibin-kum</i>	‘your PL son’

On the other hand, underlying initial consonant clusters are optionally broken up by epenthesis when the word is preceded by a pause (80a), whereas no epenthesis takes place if the cluster is preceded by a vowel-final morpheme (80b). If preceded by a morpheme ending in a single consonant, /i/ is always inserted between the first two members of the new sequence (CiCC), and C<sub>2</sub> will syllabify as coda for the syllable containing the epenthetic vowel (80c) (Erwin 1969:74–5). In sum, the data in (79b) and (80c) suggest that a sequence of three consonants across a word or morpheme boundary is always split between the first and second.

<sup>23</sup> Total assimilation of a labial obstruent to a coronal stop is not active synchronically, but has taken place in the history of the language. For example, /b/ assimilates regressively before /s/ as in //ǧibs// → ǧus<sup>f</sup> ‘mortar’ and /s/ assimilates progressively to a following /f/, e.g., //nusf// → nus<sup>f</sup> ‘half’.

## (80) Epenthesis/non-epenthesis in word-initial consonant clusters

- |    |                        |                    |                       |                        |
|----|------------------------|--------------------|-----------------------|------------------------|
| a. | <i>smi:n / simi:n</i>  | ‘fat’              | <i>ǧnu:b / ǧinu:b</i> | ‘south’                |
|    | <i>tʷi:l / tʷi:l</i>   | ‘long’             | <i>bfi:d / bfi:d</i>  | ‘far’                  |
| b. | <i>ʃtira kta:b</i>     | ‘he bought a book’ | <i>ha:ða kta:b</i>    | ‘this is a book’       |
|    | <i>mudda tʷi:la</i>    | ‘a long period’    | <i>ma nna:m</i>       | ‘we don’t sleep’       |
| c. | <i>ʃtireet i kta:b</i> | ‘I bought a book’  | <i>hal i kta:b</i>    | ‘this book’            |
|    | <i>joom i tʷi:l</i>    | ‘a long day’       | <i>raħ i nna:m</i>    | ‘we’re going to sleep’ |

When sequences of more than three consonants are encountered across a word boundary, the epenthetic vowel is placed before the last two members (CCiCC), regardless of the position of the word boundary, as in (81a) (Erwin 1963:34). This means that epenthesis has to refer to the whole structure on the phrase level. In longer sequences of five consonants, the rule applies to break first the last three-consonant sequence (CCiCC) and then the remaining three-consonant sequence (CiCCiCC) (81b), while resyllabification guarantees that the resulting structure is in accord with the syllable structure of the language (Abu-Salim 1980:3–4).

## (81) Epenthesis in (underlying) four- and five-consonant sequences

- |    |                             |   |                         |                       |                      |
|----|-----------------------------|---|-------------------------|-----------------------|----------------------|
| a. | <i>//ʔakl ktir //</i>       | → | <i>ʔakl i ktir</i>      | <i>/*ʔakil ktir</i>   | ‘plenty of food’     |
|    | <i>//ʃif-t l-wazir //</i>   | → | <i>ʃif i lwazir</i>     | <i>/*ʃifit lwazir</i> | ‘I saw the minister’ |
|    | <i>//hind t-ri:d //</i>     | → | <i>hind i tri:d</i>     | <i>/*hinid tri:d</i>  | ‘Hind wants’         |
| b. | <i>//ʃif-t l-kta:b //</i>   | → | <i>ʃifit li kta:b</i>   |                       | ‘I saw the book’     |
|    | <i>//l-tfalb l-smi:n //</i> | → | <i>lʃfalib li smi:n</i> |                       | ‘the fat dog’        |

## 2.3.3.2 Geminates, Assimilation, and Epenthesis

A compelling result of autosegmental theory is the distinction between false and true geminates. True geminates are an inherent part of Arabic templatic structure, whereas false geminates tend to arise through total assimilation, morpheme concatenation, or syncope. Representationally, a true geminate is a single node linked to two timing slots and a false geminate is a sequence of two identical consonants (Hayes 1986b).

Whereas final clusters in Baghdadi are broken up by epenthesis, a word-final true geminate cannot be disintegrated by epenthesis. Hayes (1986a) attributes this cross-linguistic tendency to a principle of *geminate integrity* (or “geminate blockage” in Schein and Steriade’s (1986) terms). Another strategy to avoid epenthesis in BA is degemination, by which a true geminate is reduced to a single consonant before a consonant-initial morpheme (see §5.3.3.3). Gemination is retained before any vowel-initial morpheme (Erwin 1969:76). These facts are exemplified in (82a–b).

## (82) Epenthesis/non-epenthesis and true geminates

- |    |                     |   |              |                 |            |
|----|---------------------|---|--------------|-----------------|------------|
| a. | <i>//sitt //</i>    | → | <i>sitt</i>  | <i>/*sitit</i>  | ‘lady’     |
|    | <i>//sitt-na //</i> | → | <i>sitna</i> | <i>/*sittna</i> | ‘our lady’ |
|    | <i>//sitt-a //</i>  | → | <i>sitta</i> | <i>/*sita</i>   | ‘her lady’ |

## 2. LOCAL PLACE ASSIMILATION

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b. //dazz //	→	dazz /*daziz	‘he sent’
//dazz-ha //	→	dazha /*dazzha	‘he sent her’
//dazz-a //	→	dazza /*daza	‘he sent it’
//dazz l-maktu:b //	→	dazz i lmaktu:b	‘he sent the letter’

On the other hand, false geminates arising from morpheme concatenation pattern like other consonant sequences in inducing epenthesis (Majdi and Winston 1993:173) and no degemination applies before a consonant-initial morpheme. The underlying form //fut-t// in (83) is comprised of a *t*-final stem attached to the 1st person singular suffix *-t*; and epenthesis ensues.

### (83) Epenthesis/non-epenthesis and false geminates

//fut-t//	→	futit /*futt	‘I passed’
//fut-ti//	→	futti /*futi	‘you FS passed’
//fut-t bil-ba:b //	→	futit bilba:b /*futt i bilba:b	‘I passed through the door’

Just like true geminates, false geminates resulting from total assimilation block the application of epenthesis and behave as if the morpheme boundary has been deleted. Let’s take the case of *l*-assimilation to a following coronal consonant. Recall from the preceding section that four- or five-consonant sequences (on the phrase level) are respectively broken up in the following fashion: CCiCC and CiCCiCC. If the last two consonants of the sequence constitute a geminate (C<sup>g</sup>C<sup>g</sup>) resulting from total assimilation, epenthesis applies regularly (CCiC<sup>g</sup>C<sup>g</sup> and CiCCiC<sup>g</sup>C<sup>g</sup>), as in (84a). However, if the geminate appears immediately before the last consonant, epenthesis applies before and/or after but not internal to the geminate: CiC<sup>g</sup>C<sup>g</sup>C or CCiC<sup>g</sup>C<sup>g</sup>iC (Rose 2000:111). As shown in (84b), the expected forms in which the epenthetic vowel splits the false geminate (viz., \*CC<sup>g</sup>iC<sup>g</sup>C and \*CiCC<sup>g</sup>iC<sup>g</sup>C) are not attested. Degemination is out of the question here, or else the resulting phrase would be ambiguous. For instance, *l-walad i zyir* ‘the boy is small’ (sentence) would also potentially mean ‘the small boy’ (noun phrase), which is not the case (Abu-Salim 1980:9).

### (84) Epenthesis in sequences that include geminates

a. //ʔakl l-ti:n //	→	ʔakl i tti:n	‘eating figs’
//dazz l-θaub //	→	dazz i θθoob	‘he sent the shirt’
b. //l-walad l-zyir //	→	lwalad i zzyir /*l-walad zizyir	‘the small boy’
//ʔakl l-zyir //	→	ʔakl i zzyir /*ʔakil zizyir	‘the little one’s food’

In a rule ordering fashion, assimilation has to precede epenthesis in order to derive the correct form, as shown in (85). The output will resist epenthesis as a result of geminate integrity, which also seems to operate on this type of false geminates. If epenthesis were ordered before assimilation, it would *bleed* it and the incorrect unassimilated form \**l-walad li-zyir* would surface.

## (85) Rule-ordering of assimilation and epenthesis

// <i>l-walad l-zyir</i> //	Underlying Representation
<i>l-walad z-zyir</i>	Assimilation
<i>l-walad i z-zyir</i>	Epenthesis
<i>l-wa<sub>σ</sub>la<sub>σ</sub>d i z-z<sub>σ</sub>yir<sub>σ</sub></i>	Syllabification
<i>lwalad i zzyir</i>	Surface Representation

To summarize so far, strings of two contiguous identical consonants separated by a morpheme boundary are split by epenthesis (83), while similar strings that result from assimilation are not (84). The immunity of the latter type of geminates to epenthesis has been the subject of various studies focusing on Arabic. A provisional explanation, following Guerssel's (1978) arguments for Moroccan, is that assimilation across a morpheme boundary serves to obliterate the boundary, blocking other processes that may apply in the same environment. Hence, a process like epenthesis is disallowed to split not only a true geminate, but also a false geminate that results from assimilation.

Interestingly, non-geminate clusters resulting from partial assimilation are also immune to epenthesis. (86) presents cases where a final cluster is optionally broken up by epenthetic /i/. If no epenthesis applies, the proper environment for regressive nasal place assimilation is created. And once assimilation has taken place, epenthesis will no longer have the context to operate (see Abu-Salim 1988:59). Hence to derive the non-assimilating output, epenthesis has to precede (partial) assimilation, in what seems like a rule ordering paradox (vis-à-vis (85)). Note that despite the free variation between the assimilating and epenthetic outputs in BA, the former is more common.

## (86) Non-epenthesis in partially assimilated clusters

<i>ɕamb /ɕanib</i> /* <i>ɕamib</i>	'beside'	<i>ɕawanib</i>	'sides'
<i>ðamb /ðanib</i> /* <i>ðamib</i>	'guilt'	<i>ðnu:b</i>	'guilts'
<i>ʕumf /ʕunuf</i> /* <i>ʕumuf</i>	'violence'	<i>ʕanif</i>	'violent'

The lack of epenthesis in these clusters is typically attributed to assimilation. As will be shown in §2.3.4.2, assimilation always results in a doubly-linked structure and some violation of faithfulness, whether or not it involves strict feature spreading. This applies equally to the outputs of partial and total assimilation. And since both types of assimilation involve action at the level of the individual feature, a unified analysis in the autosegmental framework is favored (viz., shared features rather than features that agree in values).<sup>24</sup> The essence of this analysis is that assimilatory feature-linkage in any consonant sequence provides immunity against epenthesis (compare with the *Linking Constraint* in Hayes' (1986b) analysis of Toba Batak). If this pertains to false geminates formed by assimilation across a morpheme boundary, it is unnecessary to treat these outputs as true geminates or to assume deletion of morpheme boundaries.

<sup>24</sup> Clearly, total assimilation does not mean spreading all the features of the trigger onto the target, nor does it mean spreading more features than in the case of partial assimilation (Abu-Salim 1988:56).

### 2.3.4 Features and Representations in BA Local Place Assimilation

#### 2.3.4.1 Features and Natural Classes

The various types of local place assimilation in the previous sections involve most of the BA consonant inventory. In the following discussion, the segments that trigger or target certain processes of LPA will be grouped together as natural classes, defined in terms of a shared feature or a set of features. A number of these consonants are also involved in other phonological processes in subsequent chapters, in which case the reader will be referred to the relevant chapter.

A discussion of [coronal] segments is bound to take *l*-assimilation into account. The natural class of triggers in this process /t, t̥, d, s, s̥, z, θ, ð, ð̥, r, ʃ, tʃ, tʃ̥, l, l̥/, leaving /n/ for now, are unarguably characterized by a coronal place of articulation. With no evidence to a specific node, I will temporarily call it  $\alpha$ -place[cor].

Two natural subclasses of the above consonants are the coronal stops /t, t̥, d/ and the coronal affricates /tʃ, tʃ̥/. These constitute the targets of the merge process with /ʃ/ (§2.3.2.3) and the outputs of that process, respectively. If a C-manner[closed] feature indicates a stop constriction, then coronal stops /t, t̥, d, tʃ, tʃ̥/ must have this feature. Another group of C-manner[closed] segments are the velar stops /k, g/, which trigger various assimilations. Since all the preceding phonemes show contrastive evidence for a place feature, it follows that the glottal stop /ʔ/ has a single C-manner[closed] feature. As in CA, a placeless specification for /ʔ/ is supported by its behavior as an epenthetic consonant in BA (see §2.3.1.1).

By analogy, we can hypothesize that a C-manner[open] feature characterizes the class of fricatives. The coronal fricatives /s, s̥, z, ʃ/ have this feature in addition to  $\alpha$ -place[cor].<sup>25</sup> Naturally the non-coronal fricatives /f, x, ɣ/ have C-manner[open] and additional C-place features, evidence of which is given in §4.3 (and partially later on in this section). From this, we can infer that /h/ is the placeless fricative segment in BA, given its weak articulation and tendency to delete in word-final position (see also Harris and Lindsey 1995:70).

Among the coronal obstruents above, /ʃ, tʃ, tʃ̥/ (and the surface-only consonant /ʒ/) can be grouped together based on their behavior as triggers of NPA, whereby underlying //n// is realized as a palatoalveolar nasal /ɲ/. (In addition, they constitute the blockers of emphasis spread; see §3.3.2.2). Furthermore, the assimilation of //t, t̥, d// and //ʃ// results in a third segment /tʃ̥/, which indicates that the undergoers differ in more than their manner features. These facts call for a split in the [coronal] feature between V-place[cor] that categorizes /ʃ, ʒ, tʃ, tʃ̥/ and C-place[cor] that categorizes all other coronal consonants. The division is also supported by articulatory evidence: the articulation of palatoalveolars is closer to that of palatal glides.

While a detailed discussion of voicing contrast is beyond the scope of this work, one more subdivision among the coronal obstruents can be established. I refer to the

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<sup>25</sup> As to the status of the dental fricatives /θ, ð, ð̥/ and why they do not belong in this natural class, see chapter 3 (§3.3.3.1).



distinction between emphatic and non-emphatic consonants in the pairs /t, t̤/ and /s, s̤/, where shifts from one class to the other take place under CPA. Since all of these segments have C-place[cor] and some C-manner specification, I posit that emphatic /t̤, s̤/ have an additional V-place[dor] feature.

The labial consonants /p, b, f, m/ are grouped together because of their unified behavior as triggers of NPA by which //n// is realized as a labial or labiodental nasal. I postulate a C-place[lab] feature for this natural class. /m/ is a nasal sonorant. And the fact that labial stops /p, b/ assimilate to /f/ and not vice versa (§2.3.2.4) suggests that they are most likely mannerless. If /b/ has a [voice] feature, then /p/ is composed only of C-place[lab].<sup>26</sup>

The velar stops /k, g/ and the uvular /q/ trigger NPA whereby an underlying //n// becomes a velar/uvular nasal, but unlike CA, they do not trigger *l*-assimilation. With no evidence for a velar-uvular distinction, I infer that /k, g, q/ constitute one natural class of C-place[dor] segments. Of these, uvular /q/ is more suitable for a mannerless segment, while velar /k, g/ have additional C-manner[closed]. Other segments with C-place[dor] are the velar fricatives /x, ɣ/ on account of their behavior in labialization spread (see §4.3). And the claim that they have a C-manner[open] feature explains their behavior as a “negative natural class” for NPA.

As regards the nasal sonorants /n, m, ŋ/, we will assume that, as sonorants, they are characterized by a nexus of [closed] and [open] C-manner features. The fact that under nasal and sonorant place assimilation //n// is often a target, but rarely a trigger, hints at a placeless (weaker) articulation. Thus, I propose that /n/ is only composed of C-manner[closed] and C-manner[open]. The labial nasal /m/ has C-place[lab] added to these C-manner features. Note that [m] is restricted to the output of NPA from a trigger /f/; meaning that the allophones [m] and [m̥] are in complementary distribution. In like manner, the velar/uvular nasal allophones [ŋ] and [ŋ̥] are in complementary distribution since they are restricted to the output of NPA from a velar or uvular stop trigger. I infer that they are featurally identical, with C-place[dor] in addition to C-manner[closed] and C-manner[open].

Finally, the liquid sonorants /r, l, l̥/ would naturally have C-manner[closed] and C-manner[open]. As a trigger of *l*-assimilation, the flap /r/ must have C-place[cor] in addition to C-place[dor] (see also §4.3.3). The lateral sonorants /l, l̥/ are structurally less complex since they are always targets of assimilation by /r/, but never the other way around. As the renowned targets of *l*-assimilation, they must be specified for C-place[cor] in addition to being sonorant. (See p.257 for a summary of all features).

#### 2.3.4.2 Autosegmental Representations

Based on the behavior of natural classes, this section characterizes the various types of BA local place assimilation in the autosegmental framework. Local assimilation is

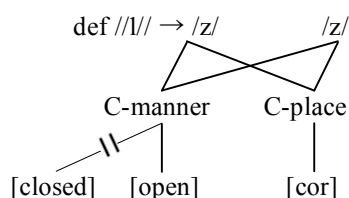
<sup>26</sup> Remarkably, /p/ is a contrastive phoneme in BA, even though it is mostly associated with loanwords. /p/ and /b/ contrast in a few minimal pairs, such as *pawwaf* ‘he veiled’–*bawwaf* ‘he put in neutral’, *pu:l* ‘stamp’–*bu:l* ‘urinate! MS’, *parda* ‘curtain’–*barda* ‘a wave of cold’ (Rahim 1980:228).

represented by dotted lines connecting a single token to two adjacent positions in the trigger and target segments. Aspects such as feature merge and feature delinking are encoded in the representations by solid or broken lines respectively.

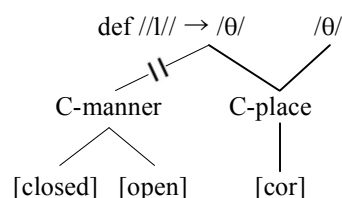
First, let us consider the total assimilation of the definite article *l-* to contiguous coronal consonants. As in Cairene, the main motivation behind this process is an OCP violation against adjacent coronals (Zemánek 2006:204), resolved by merging the two C-place[cor] features. In contrast to CA, however, no spreading of manner features occurs because: (i) the trigger has no manner feature at all (given /θ, ð, ðʰ/), or (ii) the trigger's manner feature is already shared with the target to avoid another OCP violation (given all the other triggers). The basic idea is that any C-manner feature on the target is delinked unless it is shared with the trigger. As shown in (87a–b), the output of this machinery is always a false geminate. (Sonorant triggers /n, r/ are accounted for under sonorant assimilation in (91) below).

(87) *l*-assimilation to C-place[cor] segments

a. //l-zibd// → z-zibid

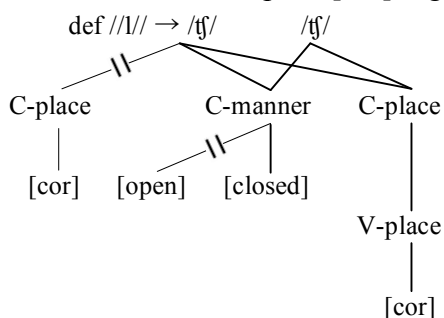


b. //l-θaub// → θ-θoob



Because the segments /ʃ, tʃ, ɟʒ/ with V-place[cor] are also triggers of *l*-assimilation, I propose that the OCP is violated by a [coronal] feature that is attached to different nodes. Fusion ensues, in which case the rightmost place node overrides the target's C-place node (88). This will activate deletion of the unshared C-manner feature on the target in the above fashion.

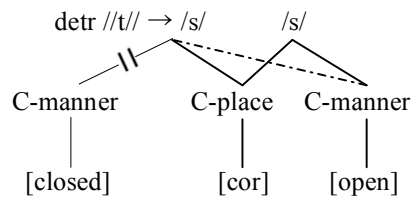
(88) *l*-assimilation to a V-place[cor] segment: //l-tʃa:ku:tʃ// → tʃ-tʃa:ku:tʃ



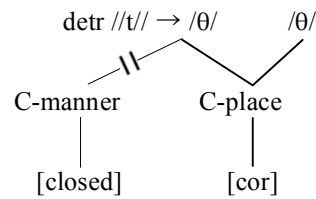
The total assimilation of various *t-* prefixes to the class of non-sonorant coronals /t, tʰ, d, s, sʰ, z, θ, ð, ðʰ, ʃ, tʃ, ɟʒ/ is also motivated by an OCP [coronal] violation (within or across tiers) followed by merge or sharing of the rightmost place feature. As shown in (89a–b), this creates the environment for spreading the rightmost manner feature—if present—and delinking the leftmost.

(89) Total assimilation of the imperfect second person prefix *t-*

a. //t-sa:maħ // → s-sa:maħ



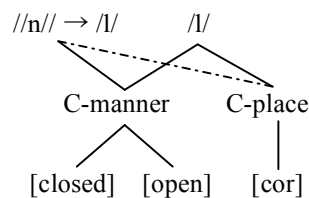
b. //t-θi:ri:n // → θ-θi:ri:n



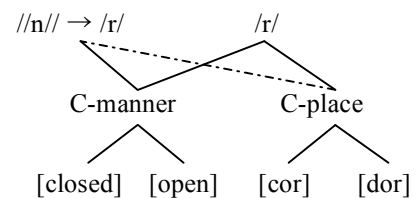
Moving to general assimilations in BA, we start with the total regressive assimilation of sonorants. The mandatory assimilation of //n// to a subsequent liquid /l, r/ entails leftward spreading of the feature C-place[cor], as well as C-place[dor] in the case of /r/. Participating segments agree in sonority, which means that the shared C-manner representations in (90a–b) provide the sequence with the environment to apply. The result is spreading of the relevant place feature(s).

(90) Total assimilation of //n// to a following /l/ and /r/

a. //ʔin-laʕbak // → ʔillaʕbak



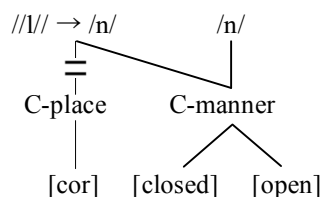
b. //man-ru:ħ // → marru:ħ



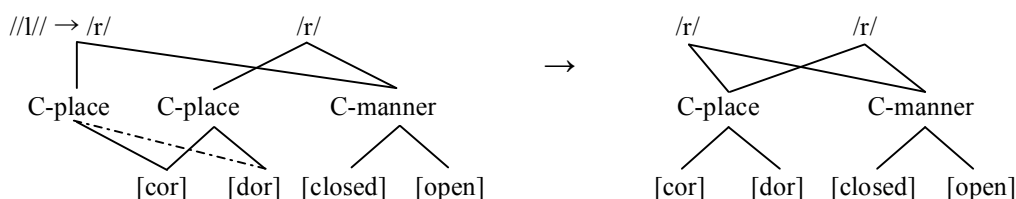
The regressive total assimilation of //l, ĩ// to /n/ is also motivated by simultaneous OCP violations on C-manner[closed] and C-manner[open]. However, the trigger /n/ has no place node to spread leftwards, and the result is delinking of the target's C-place feature, as illustrated in (91a). Notice that this is the only type of assimilation triggered by /n/, and it accounts for why /n/ is traditionally grouped with the triggers of the definite article assimilation, even though it does not have a C-place[cor] feature contrastively. On the other hand, the complete assimilation of //l, ĩ// to a following /r/ takes place when the trigger and target merge their C-manner features as well as C-place[cor] to avoid multiple OCP violations (91b). While this activates spreading of C-place[dor], spreading of the emphatic feature V-place[dor] involves an independent mechanism (see (94) below).

(91) Total assimilation of //l// to a following /n/ and /r/

a. //baddal-na // → baddanna



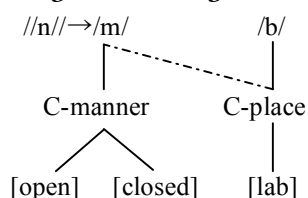
b. //staʃmal raff// → staʃmar raff



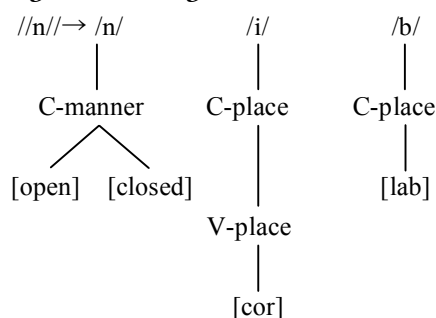
In BA nasal place assimilation, //n// assimilates regressively in place to an obstruent with one of the features: C-place[lab], C-place[dor] (excluding fricatives), or V-place [cor]. A trigger may share only one C-manner feature with the target //n// or none at all. (92a) shows partial assimilation to a labial feature, while (92b) shows the same cluster separated by epenthetic /i/ where no assimilation takes place.<sup>27</sup> The diagrams in (92c–d) illustrate NPA triggered by palatal obstruents and velar stops, respectively.

(92) Partial nasal place assimilation to various triggers

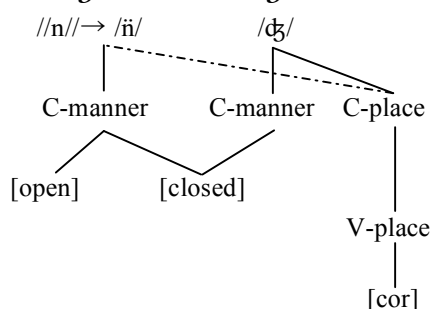
a. //ɕʌnb// → ɕʌmb



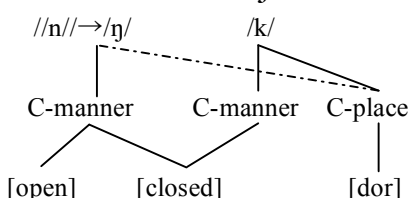
b. //ɕʌnb// → ɕʌnib



c. //n-ɕʌmaʃ// → n̩ɕʌmaʃ



d. //ʃʌnkabu:t// → ʃʌŋkabu:t

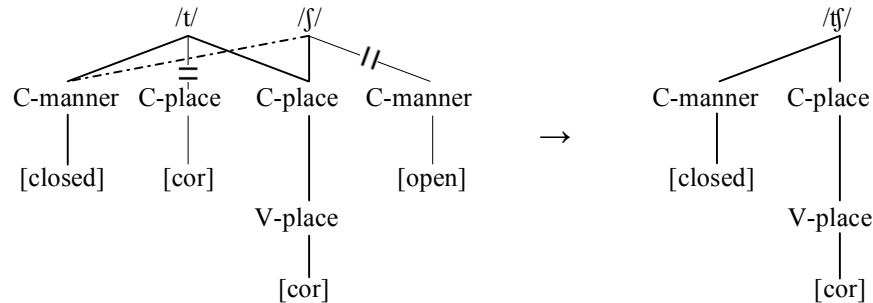


Section 2.3.2.3 describes three subtypes of coronal place assimilation in BA, the first of which is the coalescence of a coronal stop //t, t̥, d// with a following palatoalveolar fricative //ʃ// to form an affricate /tʃ/. Again, fusion by dominance of the rightmost place feature is created by an OCP [cor] violation across tiers (93). An additional

<sup>27</sup> Odden (1988) mentions a similar case of OCP-motivated fusion in Yir Yoront, which separates stop clusters by a schwa, providing the consonants are not homorganic (cited from Alpher (1973)). He assumes that identical place features are fused by the OCP, resulting in the failure of epenthesis.

requirement to spread C-manner[closed] rightwards and the consequent loss of C-manner[open] result in the output /tʃ/.

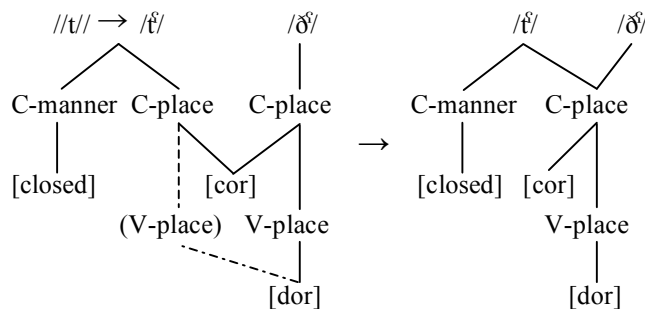
(93) Assimilation of //t// and //ʃ// to an output /tʃ/: //jit-fa:lab// → jitʃa:lab



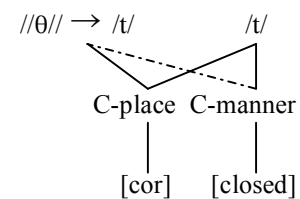
Another type of CPA is the regressive assimilation of the emphatic feature from /t̤, s̤, ʃ̤/ to non-emphatic coronals. This process requires that the target and trigger merge C-place[cor], but not necessarily MANNER, to repair an OCP violation. As a result, the feature V-place[dor] spreads leftwards in the sequence, as shown in (94a). Parallely, assimilation of the dentals //θ, ð, ʃ̤// before /t/ is motivated by sharing C-place[cor], but it is the feature C-manner[closed] that spreads (94b).

(94) Two instances of CPA

a. //naba:t̤ ð̤axim// → naba:t̤̤ ð̤̤axim



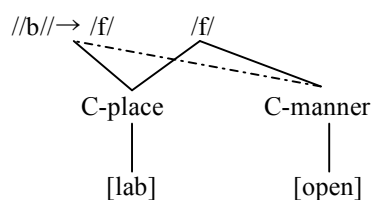
b. //biʃaθ-ta// → biʃa{t}ta



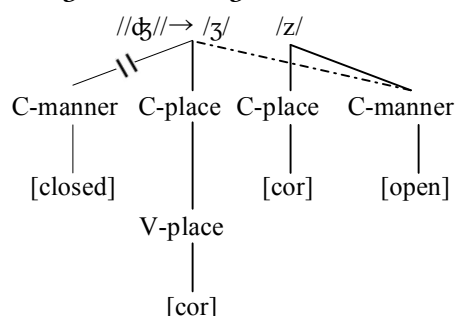
Assimilation of a stop to an adjacent homorganic fricative is caused by an OCP violation, where homorganicity spans both coronal and non-coronal place features. For example, the assimilation of a labial stop //b// to a homorganic fricative /f/ (95a) is caused by sharing C-place[lab] and consequent spreading of the rightmost C-manner [open] feature. In the partial assimilation of an affricate //tʃ, ʒ// to a following coronal fricative, the OCP violation on different place nodes is not repaired by sharing one or the other [cor] features,<sup>28</sup> but rather the target will become a palatoalveolar fricative /ʃ, ʒ/ after the shift in its C-manner feature. This is illustrated in diagram (95b).

<sup>28</sup> Recall that feature merge is the unmarked—and hence prioritized—strategy to repair OCP violations, but it is by no means an automatic mechanism. This follows from the blocking of epenthesis by lexical geminates and those derived through assimilation, but not by adjacent identical consonants (§2.3.3.2).

## (95) Assimilation of stops to homorganic fricatives

a. //b// + *faras* // → *ffaras*

b. //ʔaɖʒzaːʕ// → ʔaʒzaːʕ



## 2.3.5 Constraints and Local Place Assimilation in BA

This section proposes an analysis of Baghdadi Arabic LPA and its interaction with epenthesis in Optimality Theory. Assimilations result in part from corrections to the OCP and from constraints that directly require feature alignment, and their interaction with various faithfulness and markedness constraints in the grammar. The analysis follows the order of presentation in §§2.3.1–2.3.2.

The assimilations of the definite article *l-* and of prefixal *t-* call for the constraints NOGEM in (36b) and OCP [cor], against adjacent [coronal] features on the same node or across nodes. Both types of OCP violation are repaired by fusion, and in the latter case we need the crucial ranking  $\text{DEPLINK [cor]}/C_2 \gg \text{DEPLINK [cor]}/C_1$  to guarantee dominance of the rightmost place node in the triggers /ʃ, tʃ, ɖʒ/.

While CA employs active alignment of a C-manner feature to the mannerless target //l//, no such alignment is possible in BA where //l// has both C-manner[open] and C-manner[closed]. In order to formulate the idea that any C-manner feature on the target is delinked unless it is shared with the trigger, I posit the indexed markedness constraints in (96a–b) which ban different feature specifications on two adjacent C-manner nodes when the sequence shares some [coronal] feature. Failure on these constraints is repaired by deleting the different manner feature on  $C_1$ , that is, by violating MAX C-manner[F].

(96) a.  $*C\text{-[open]}_{\text{def}}C\text{-[closed]}_{\text{cor}}$ : Given an output  $C_1C_2$  sequence where  $C_1$  is the definite article, if  $C_2$  has C-manner[closed] then  $C_1$  may not have C-manner[open] *iff*  $C_1$  and  $C_2$  share a feature [cor].

b.  $*C\text{-[closed]}_{\text{def}}C\text{-[open]}_{\text{cor}}$ : Given an output  $C_1C_2$  sequence where  $C_1$  is the definite article, if  $C_2$  has C-manner[open] then  $C_1$  may not have C-manner[closed] *iff*  $C_1$  and  $C_2$  share a feature [cor].

The following tableau examines *l*-assimilation to /tʃ/. The adjacent [coronal] features in candidate (97a) are disallowed, and the OCP enforces feature sharing, as in (97b). However, this candidate is ruled out by  $*C\text{-manner[open]}_{\text{def}}C\text{-manner[closed]}_{\text{cor}}$ . The

suboptimal candidate (d) shares C-place[cor], thus failing on DEPLINK [cor]/C<sub>2</sub>. (97c) wins, although it violates MAX C-[open] and NOGEM.

(97) OCP [cor], OCP C-[closed], DEPLINK [cor]/C<sub>2</sub>, \*C-[open]<sub>def</sub>C-[closed]<sub>cor</sub> >> DEPLINK [cor]/C<sub>1</sub>, MAX C-[open], NOGEM

	//l-tʃa:ku:tʃ//	OCP [cor]	OCP C-[closed]	DEPLINK [cor]/C <sub>2</sub>	*C-[open] <sub>def</sub> C-[closed] <sub>cor</sub>	DEPLINK [cor]/C <sub>1</sub>	MAX C-[open]	NOGEM
a.		*!	*!					
b.					*!	*		
c.						*	*	*
d.				*!			*	*

Now let us consider other potential triggers. Coronal fricative triggers /s, z, sʰ/ are simply accounted for by replacing two constraints in the above ranking: \*C-[closed]<sub>def</sub>C-[open]<sub>cor</sub> >> MAX C-[closed], all things being equal. The mannerless triggers /θ, ð, ðʰ/ are challenging unless we allow for an empty C-manner[φ] that causes delinking of the target's C-manner features, given the ranking: \*C-[open, closed]<sub>def</sub>C-manner[φ]<sub>cor</sub> >> MAX C-[open], MAX C-[closed].

Assimilating to a trigger /t/ does not follow from featural markedness alone. The basic constraint is one that demands alignment of C-place[dor] to the definite article (98a), which outranks DEPLINK C-[dor], as shown in (98b).

- (98) a. L-ALIGN C-[dor]/C<sub>def</sub>C<sub>[dor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence where C<sub>1</sub> is the definite article, if C<sub>1</sub> and C<sub>2</sub> share a feature [cor], then the left edge of C-place [dor] must be aligned to the left edge of the sequence.
- b. OCP [cor], OCP C-[open], OCP C-[closed], L-ALIGN C-[dor]/C<sub>def</sub>C<sub>[dor]</sub> >> DEPLINK C-[dor], NOGEM

The total assimilation of prefixal *t*- requires the direct alignment imperative in (99a) when the trigger and target share some [cor] feature. The stop triggers /t, t̥, d, tʃ, dʒ/ simply share their C-manner feature with the target //t// to avoid OCP violation. Assimilation to the fricatives /s, z, s̥, ʃ/ involves violation of DEPLINK C-[open]. As for the mannerless triggers /θ, ð, ð̥/, we must allow for [F] in the constraint to refer to an empty feature [∅] (in addition to [open] and [closed]). And to guarantee loss of the target's C-manner[closed] feature, I introduce the conjoined constraint in (99b). The final ranking is given in (99c). (As in CA, sonorant /l, l̥, r/ are not triggers; hence the crucial ranking DEPLINK C-[open] & \*C-[closed] >> ALIGNMENT).

- (99) a. L-ALIGN C-manner[F]/C<sub>pref</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence where C<sub>1</sub> is the prefixal *t*- morpheme, if C<sub>1</sub> and C<sub>2</sub> share a feature [cor], then the left edge of C-manner[F] must be aligned to the left edge of the sequence.
- b. DEPLINK C-[open] & \*C-[closed]: Do not associate C-manner[open] to a segment that has C-manner[closed] on the surface.
- c. OCP [cor], DEPLINK C-[open] & \*C-[closed] >> L-ALIGN C-manner[F]/C<sub>pref</sub>C<sub>[cor]</sub> >> DEPLINK C-[open], MAX C-[closed], NOGEM

Next I examine the regressive assimilation of sonorants: triggered by /m, l, l̥, r/ and targeting //n//, or triggered by /r/ and targeting //l, l̥//. In all of these cases, some place feature (C-place[lab], C-place[cor], C-place[dor], and V-place[dor]) spreads leftward to a target that shares both C-manner[closed] and C-manner[open] with the trigger. It follows that only the constraint in (100) is necessary, and it is in conflict with the corresponding DEPLINK constraint.

- (100) L-ALIGN α-place[F]/C<sub>SON</sub>C<sub>SON</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share both C-manner[closed] and C-manner[open], then the left edge of α-place [F] must be aligned to the left edge of the sequence.<sup>29</sup>

Tableau (101) evaluates an input //n-r// in which adjacent segments agree in sonority. An output in which those segments also agree in PLACE (101d)—and hence become identical—wins over the input-faithful alternative (101a). Candidate (c), which aligns only one place feature, still fails on ALIGNMENT.

<sup>29</sup> I must admit that the assimilation of //l// to a following /n/ is slightly problematic in this analysis.



(101) OCP C-manner[F] >> L-ALIGN  $\alpha$ -place[F]/C<sub>SON</sub>C<sub>SON</sub> >> DEPLINK C-[dor],  
DEPLINK C-[cor], NOGEM

	//man-ru:ħ //	OCP C-manner[F]	L-ALIGN $\alpha$ -place [F]/C <sub>SON</sub> C <sub>SON</sub>	DEPLINK C-[dor]	DEPLINK C-[cor]	NOGEM
a.		*!*				
b.			*!*			
c.			*!		*	
d.				*	*	*

The above ranking also explains why no assimilation takes place from a trigger /l/ to target //r/, given the featural composition of these segments. A potential trigger /l/ has no extra place feature(s) to align to //r/. Hence, a geminate output would mean deleting features from the target, and such an output will always be eliminated by MAX constraints (even if they are low ranked).

NPA differs from the previous sound changes in that its outcome is not a false geminate. It is a type of partial place assimilation where the relevant constraints must align C-place[lab], C-place[dor], or V-place[cor] to an NC configuration. These are in conflict with three constraints against the output structures, either non-contrastive /ŋ, ñ/ or contrastive /m/. Tableau (102) exemplifies //n// assimilation to a palatoalveolar //ɲ/. The high-ranked alignment constraint rules out candidate (102b). The optimal candidate (102c) violates DEPLINK in addition to the markedness constraint against non-contrastive palatoalveolar nasals \*V-[cor] & C-[closed, open].

(102) OCP C-manner[F], L-ALIGN V-[cor]/NC >> \*V-[cor] & C-[closed, open], DEPLINK V-[cor]

	//n-ɕɪmaɸ //	OCP C-manner[F]	L-ALIGN V-[cor]/NC	*V-[cor] & C-[closed, open]	DEPLINK V-[cor]
a.		*!			
b.			*!		
c.				*	*

The constraint in (103a) militates against outputs in which the trigger and target share C-manner[open]. Thus in cases where the potential trigger of NPA is a velar fricative /x, ɣ/, no assimilation takes place; i.e., ALIGNMENT is violated by the optimal output.

(103) a. DEPLINK C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub>: For every NC sequence sharing C-manner[open], do not associate C-place[dor] to a segment that did not have it underlyingly.

b. OCP C-manner[F], DEPLINK C-[dor]/C<sub>[op]</sub>C<sub>[op]</sub> >> L-ALIGN C-[dor]/NC >> \*C-[dor] & C-[closed, open], DEPLINK C-[dor]

The merge of a coronal stop with a following palatoalveolar fricative //ʃ// to create an affricate /tʃ/ calls for the alignment imperative in (104a). The target and trigger share the rightmost V-place[cor] feature as a result of the crucial ranking DEPLINK [cor]/C<sub>2</sub> >> DEPLINK [cor]/C<sub>1</sub>. Alignment of the leftmost C-manner[closed] feature pursues, with an output that violates the high-ranked conjoined constraint in (104b). Deleting C-manner[open] yields an output sequence with C-manner[closed] and V-place[cor], which is articulatorily realized as affricate /tʃ/.

- (104) a. R-ALIGN C-[closed]/C<sub>[cor]</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share a feature [cor], then the right edge of C-manner[closed] must be aligned to the right edge of the sequence.
- b. DEPLINK C-[closed] & \*C-[open]: Do not associate C-manner[closed] to a segment that has C-manner[open] on the surface.
- c. OCP [cor], DEPLINK [cor]/C<sub>2</sub>, R-ALIGN C-[closed]/C<sub>[cor]</sub>C<sub>[cor]</sub>, DEPLINK C-[closed] & \*C-[open] >> DEPLINK [cor]/C<sub>1</sub>, DEPLINK C-[closed], MAX C-[open]

A second type of CPA is the assimilation of V-place[dor] from /t<sup>s</sup>, s<sup>s</sup>, ð<sup>s</sup>, l̥/ to an adjacent plain coronal. The relevant constraint in (105a) demands alignment of the emphatic feature only if the target and trigger share C-place[cor], and DEPLINK V-[dor] in (105b) must be ranked below ALIGNMENT. An example is the target //t// in Tableau (106) which surfaces with emphasis in the output. (Voicing assimilation is assumed, but not accounted for).

- (105) a. L-ALIGN V-[dor]/C<sub>[cor]</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-place[cor], then the left edge of V-place[dor] must be aligned to the left edge of the sequence.
- b. DEPLINK V-[dor]: Do not associate V-place[dor] to a segment that did not have it underlyingly.

(106) OCP C-[cor], L-ALIGN V-[dor]/C<sub>[cor]</sub>C<sub>[cor]</sub> >> DEPLINK V-[dor]

	//nabat: ð <sup>s</sup> axm //	OCP C-[cor]	L-ALIGN V-[dor]/ C <sub>[cor]</sub> C <sub>[cor]</sub>	DEPLINK V-[dor]
a.		*!		
b.			*!	
c.				*

## 2. LOCAL PLACE ASSIMILATION

To account for the assimilation of //θ, ð, ð̥// before /t/ (94b), we need a parallel constraint (107a). But since the targets do not include the coronal fricatives //s, z, s̥//, constraints against linking C-manner[closed] to a target with C-manner[open] and against deleting C-manner[open] are also highly ranked (107b).

- (107) a. L-ALIGN C-[closed]/C<sub>[cor]</sub>C<sub>[cor]</sub>: Given an output C<sub>1</sub>C<sub>2</sub> sequence, if C<sub>1</sub> and C<sub>2</sub> share C-place[cor], then the left edge of C-manner[closed] must be aligned to the left edge of the sequence.
- b. L-ALIGN C-[closed]/C<sub>[cor]</sub>C<sub>[cor]</sub>, DEPLINK C-[closed] & \*C-[open], MAX C-[open] >> NOGEM

As regards the assimilation of labial stops to their homorganic fricatives, the relevant constraint, L-ALIGN C-[open]/C<sub>[lab]</sub>C<sub>[lab]</sub>, is parallel to (107a): it requires alignment of C-manner[open] if the sequence shares C-place[lab]. The leftward direction of alignment guarantees that the reverse order (fricative + stop) does not cause assimilation. In the following tableau, candidates (118a) and (118b) are ruled out by OCP C-[lab] and ALIGNMENT, respectively. (108c) wins by passing these high-ranked constraints.

- (108) OCP C-[lab], L-ALIGN C-[open]/C<sub>[lab]</sub>C<sub>[lab]</sub> >> DEPLINK C-[open], NOGEM

	//b + faras //	OCP C-[lab]	L-ALIGN C- [open] /C <sub>[lab]</sub> C <sub>[lab]</sub>	DEPLINK C-[open]	NOGEM
a.		*!			
b.			*!		
c.				*	*

Finally, we need to account for the interaction of epenthesis and assimilation in BA. That epenthesis generally splits word-final clusters entails ranking the constraint against coda clusters, \*COMPCODA, lower than one against vowel insertion, DEP-V.<sup>30</sup> Moreover, the fact that epenthesis does not affect true geminates suggests that NOGEM is also ranked lower than DEP-V (Baković 2005:296), as shown in Tableau (109).

<sup>30</sup> Until the detailed discussion of BA epenthetic vowels in chapter 4 (§4.3), I simply use DEP-V (with no reference to the featural content of the vowel).

(109) True geminates: DEP-V &gt;&gt; NOGEM, \*COMPCODA

	//sitt//	DEP-V	NOGEM	*COMPCODA
a.	sitit	*!		
b.	sitt		*	*

As noted earlier, false geminates resulting from morpheme concatenation pattern like other consonants in inducing epenthesis. Nonetheless, the previous ranking cannot account for surface forms where two adjacent identical consonants belong to different morphemes, as in //fut-t// ‘I passed’. To formulate an even higher ranked markedness constraint against the ill-formed surface output \**futt* would also rule out outputs with a false geminate arising through assimilation since there is no surface representational distinction between the two. The distinction can be captured if the constraint refers to the domain in which NOGEM applies, as in (110). Tableau (111) shows that when NOGEM/MORPH<sup>1</sup> is ranked above DEP-V, it would predict epenthesis in *futit*, but would be vacuously satisfied in Tableau (109).

(110) NOGEM/MORPH<sup>1</sup>: Geminate consonants across morpheme boundaries are disallowed in the output.(111) False geminates: NOGEM/MORPH<sup>1</sup> >> DEP-V >> NOGEM, \*COMPCODA

	//fut-t//	NOGEM/MORPH <sup>1</sup>	DEP-V	NOGEM	*COMPCODA
a.	futit		*		
b.	futt	*!		*	*

Recall that false geminates resulting from assimilation are immune to epenthesis, even in cases where the geminate is formed across a morpheme boundary, as in the output of *l*-assimilation. Sequences resulting from partial assimilation behave in a similar fashion, and I argued in §2.3.3.2 that assimilatory feature-linkage is what blocks epenthesis in both cases. The typical geminate integrity effect (Hayes 1986a) does not suffice here, and I propose the constraint LINK [F]-INTEG in (112), which operates only on assimilated sequences. Whether or not (regressive) assimilation involves feature spreading, the outcome always has a doubly-linked structure and a faithfulness violation of some sort (DEP, MAX, or DEPLINK). The feature pertinent to the faithfulness constraint varies from one process to another; it can be the same shared feature or some other feature. As a consequence, this constraint does not apply to non-assimilating sequences with merged identical features, such as (111a).

(112) LINK [F]-INTEGRITY: Given an output sequence C<sub>1</sub>C<sub>2</sub>, if C<sub>1</sub> violates FAITH[F<sub>i</sub>] and C<sub>1</sub> and C<sub>2</sub> share a feature [F<sub>j</sub>] (where [F<sub>i</sub>] = or ≠ [F<sub>j</sub>]), then the sequence may not surface as C<sub>1</sub>VC<sub>2</sub>.

## 2. LOCAL PLACE ASSIMILATION

The effect of *l*-assimilation on epenthesis is demonstrated in Tableau (113). For our purposes, all markedness constraints motivating the process are lumped together into a single cover constraint LINK [F]. Likewise, epenthesis-inducing syllable structure requirements are lumped together into a PHONOTACTICS constraint. The fully-faithful candidate (113a) violates both LINK [F] and PHONOTACTICS, whereas candidates (b) and (c) incur one violation of each. Candidate (113d) circumvents both violations at the cost of splitting a doubly-linked structure, and hence it falls victim to LINK [F]-INTEG. The winning candidate (113e) conforms to all three top-ranked constraints, but still violates NOGEM/MORPH<sup>1</sup>.

(113) PHONOTACTICS, LINK [F]-INTEG, LINK [F] >> NOGEM/MORPH<sup>1</sup> >> DEP-V >> NOGEM, MAX C-[closed]

	//l-walad l-zyi:r//	PHONOTACTICS	LINK [F]-INTEG	LINK [F]	NOGEM/MORPH <sup>1</sup>	DEP-V	NOGEM	MAX C-[closed]
a.	...d lzyi:r	*!		*!				
b.	...d lizyi:r			*!		*		
c.	...d zzyi:r	*!			*		*	*
d.	...d zizyi:r		*!			*		*
e.	...d i zzyi:r				*	*	*	*

The tableau in (114) reveals that the same ranking schema captures the interaction of epenthesis with nasal place (partial) assimilation. The assimilation-driving constraint, L-ALIGN C-[lab]/NC, outranks NOGEM/MORPH<sup>1</sup> (irrelevant here) and, by transitivity, outranks DEP-V as well. The non-assimilating candidates (114a) and (114c) are ruled out. The assimilating suboptimal candidate (114d) fails on LINK [F]-INTEG or even on the lower-ranked DEP-V. The optimal output (114b) violates \*COMPCODA in addition to DEPLINK constraints.

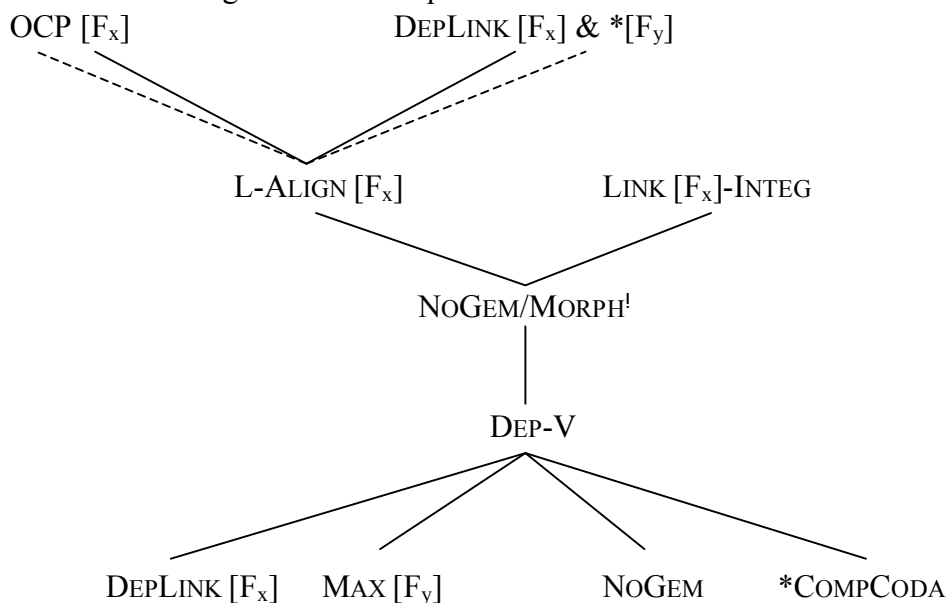
Recall, however, that there is variation between the assimilating and epenthetic outputs in BA, making candidates like /nib/ (114c) optimal for some speakers. Here the correct output falls out for free, given the (re)-ranking: LINK [F]-INTEG, \*COMP CODA >> L-ALIGN C-[lab]/NC >> DEP-V, *ceteris paribus*. The significance of LINK [F]-INTEG becomes apparent as it eliminates the output /mib/, whereas \*COMPCODA eliminates /nb/ and /mb/. This confirms the idea that a doubly-linked assimilatory representation grants stability to a sequence of consonants, whether or not they forms a geminate.

(114) LINK [F]-INTEG, L-ALIGN C-[lab]/NC >> DEP-V >> \*COMPCODA, DEPLINK C-[lab] & \*C-[closed, open], DEPLINK C-[lab]

	// ʒanb //	LINK [F]-INTEG	L-ALIGN C-[lab]/NC	DEP-V	*COMPCODA	DEPLINK C-[lab] & *C-[closed, open]	DEPLINK C-[lab]
a.			*!		*		
b.					*	*	*
c.			*!	*			
d.		*!		*		*	*

The basic ranking pattern for local place assimilation in BA is similar to that of CA above. To predict the lack of epenthesis upon assimilation, LINK [F<sub>x</sub>]-INTEG crucially dominates NOGEM/MORPH<sup>1</sup> and DEP-V. These rankings are depicted in the following Hasse diagram.

(115) Constraint rankings for BA local place assimilation



## 2.4 Conclusion

This chapter is a detailed account of local place assimilation in Cairene and Baghdadi Arabic, extending also to some related assimilations of manner features. CA and BA exhibit a diverse spectrum of LPA patterns that fall within the parameters of direction and domain. More processes of LPA are observed in CA compared to BA, and within the area of overlap a certain degree of variation can be noticed—e.g., in the triggers of a specific process. Such language-specific distributions are accurately reflected in the featural makeup of each consonant inventory. Feature specifications in each variety are assigned so that they capture the contrastive phonological behavior of trigger and target segments, and at the same time mirror some universal phonetic generalizations. Examples are the clear preference for coronal targets and non-coronal triggers, and for regressive over progressive assimilation, in accordance with Jun (1995).

Additionally, this chapter attempted to resolve some representational issues about the nature of LPA. Assimilation in autosegmental phonology involves a single token simultaneously associated to two positions. Three logical possibilities have made an appearance above. (i) *Replacement*: a feature may spread from the trigger segment to a position occupied by another feature in an adjacent segment in which case the latter has to be delinked; examples are the total assimilation of prefixal *t*- and the assimilation of a labial stop to a homorganic labial fricative. (ii) *Insertion*: a feature may spread to an unoccupied position under a certain root node in another segment; some examples are NPA, emphatic feature assimilation, and //h//-assimilation in Cairene. (iii) *Deletion*: a feature may delink from the target segment with no features spreading from the trigger; an example is *l*-assimilation in Baghdadi. In nearly every case discussed, the target and trigger segments must share some feature(s) as a prerequisite



to undergoing assimilation; and in this respect a distinction between spreading and sharing is important to the analysis. I suggested that feature sharing (fusion) is the most favorable correction of OCP violations, and made the proposition that identical features across different tiers can undergo fusion, which is the only sound change in some cases (e.g., CA adjacent sibilants).

Finally I tackled the challenge of a unified analysis of LPA in classic Optimality Theory. Most processes of LPA can be viewed as spreading imperatives requiring a feature to be multiply linked or extended in its domain in the output (Padgett 1995). I used Generalized Alignment constraints, which demand a feature to be aligned with a particular edge of the domain sequence. Linking segments to new features is at odds with some DEPLINK constraint(s), whereas potential delinking of the target's parallel feature incurs violations of basic faithfulness constraints, DEP [F] and MAX [F]. And where applicable, a constraint such as LINK [F]-INTEG is used to capture the resistance of assimilated sequences to epenthesis. In the interesting instances where only fusion across tiers occurs, assimilation falls out from (markedness) violations of some OCP [F] constraint, and no spreading imperative is necessary. And lastly to validate a point discussed in chapter 1, the microvariation between Cairene and Baghdadi is captured by differences in representations rather than rankings. The reason is that standard OT typologies where constraints make the exact same reference to natural classes across languages or dialects are rejected in the current approach.



## CHAPTER 3

### Emphasis Spread

#### 3.1 Background

##### 3.1.1 Terminology and Correlates

The great majority of modern Arabic dialects contain a set of consonants known as emphatics. Some common instances are /t̤, d̤, s̤, z̤, ḏ̤/. These emphatics often contrast with non-emphatic counterparts, a strategy used to optimize the number of phonemic oppositions in the language. In addition, emphatics can influence adjacent strings of segments in a process of *emphasis spread* (henceforth ES). ES can be defined as long distance (place) assimilation by which a phonological feature extends over more than one segment through a regular pattern—e.g., Cairene //baʔal-na// ‘our hero’ surfaces as *baʔaʔal-na* with overall emphasis. And although a widespread phenomenon across the Arabic-speaking region, ES shows a broad range of phonological variation in the dialects. Major differences concern its domain of application, its directionality, and the identity of the contrastive emphatic trigger and (if any) opaque segments.

The frequent use of such a vague cover term as *emphasis*, which is a translation of the Arabic word *tafxīm*, is the product of a long-standing terminological debate. A number of articulatory labels can be found in the literature, most notably pharyngealization (Jakobson 1957, Royal 1985), uvularization (Dolgopolsky 1977, Zawaydeh 1999), velarization (Obrecht 1968), dorsalization (Halle et al. 2000), and retraction (el-Dalee 1984). In addition, a variety of distinctive features have been proposed to characterize the emphatics, some are neutral while others are articulatorily or acoustically based (see Davis 1993:149–50 for an overview). All these terms and features reflect the disagreement between linguists with regard to the exact articulatory and acoustic correlates of emphasis in Arabic.

Articulatorily, we may describe emphasis as a “secondary articulation involving the retraction of the tongue root toward the back wall of the pharynx” (Ghazeli 1977, Younes 1982, Laufer and Baer 1988). Despite the general agreement that the tongue dorsum is the active articulator, the actual site of pharyngeal constriction is a source of dispute; whether it is the upper pharynx—ergo uvularization/velarization—or the

lower pharynx. This has led more Arabic scholars to lean toward the phonetic label “pharyngealization”, which refers to the general role of the pharynx in the articulation of emphasis (Bellem 2007:57). Pharyngealization may be accompanied by other gestures, particularly some degree of protrusion and rounding of the lips (see Jakobson 1957). After all, it is probable that Arabic dialects have varying degrees of a certain articulatory exponent or even slightly different exponents of emphasis to start with.

In acoustic terms, emphasis is marked by a narrowing of the difference between the first and second formants as compared to a non-emphatic sound. This is due either to a higher  $F_1$  and lower  $F_2$  or a lower  $F_2$  and no difference in  $F_1$  (Schulte 1985:11). Target vowels often become retracted or more centralized than their non-emphatic counterparts, which is why  $F_2$  lowering is the most recognized cue of emphasis (Card 1983, Shahin 2002). The variation in  $F_1$  values reflects that some target vowels retain the same height while others become slightly lower in emphatic contexts. Emphasis in the consonants is more difficult to detect, but it has been verified by the formant onsets and/or offsets of the vowels in the consonant’s vicinity (el-Dalee 1984).

Emphasis in both its articulatory and acoustic aspects caught the attention of the early Arab grammarians. It has traditionally been regarded as a feature inherent in the emphatic consonants, which are phonemically distinct from their plain counterparts. In his famous linguistic treatise *al-Kitāb*, Sibawayh coined the term *ītbāq*—literally “covering with a lid”—to classify the four emphatic coronal consonants /t̤, d̤, s̤, ḍ̤/ of Standard Arabic. His description of *ītbāq* as the additional raising of the tongue root towards the velum (see al-Nassir 1993:51) corresponds to the “velarized” secondary articulation proposed by some modern linguists. Sibawayh also mentions instances of long-distance assimilatory effects of the emphatic feature on non-adjacent segments (ibid., p.79). Another term, *tafxīm*, has been used by the Quranic orthoepists to distinguish emphatic from non-emphatic contexts for sonorant /r/ and /l/ (al-Hamed 2003: 480–91). However, the term was later used by the old and modern Arab grammarians to refer to the feature of emphasis in general.

### 3.1.2 Recent Accounts of Emphasis Spread

The intricacies of emphasis spread have also raised curiosity in more recent Western studies of Arabic dialects and of general phonological phenomena. Over half a century of research has produced a range of analyses for ES within all frameworks. This section provides a critical overview of the three main approaches, which treat emphasis as an underlying feature of segments, either consonants or vowels, or as a prosodic feature. The discussion aims to shed light on their inadequacies and, consequently, to emphasize the strengths of the proposed account to ES. Having said that, my analysis owes a great deal to the insights of each of these previous accounts.

#### 3.1.2.1 The Suprasegmental Account

In view of the inescapable extension of the emphatic feature beyond the segment over a larger domain, several linguists have interpreted emphasis as a prosodic feature (see

e.g., Lehn 1963, Broselow 1976, Tsereteli 1982, inter alia). For this approach, it is a primary concern to define the domain of emphasis. Most accounts regard the syllable as its minimal domain (Norlin 1987), hence the name “suprasegmental approach”. Proponents of this approach prefer to recognize no underlying emphatic vowels or consonants at all and treat emphasis as a redundant feature of the consonantal and vocalic systems (Lehn 1963); but only few of them analyze emphasis as a “feature” of the entire syllable (e.g., Kaye 1997). From the syllable, emphasis may spread over a larger domain, the utterance, affecting both vowel and consonant qualities.

A strong argument against this approach is that only certain segments, the coronal emphatics, provide contrasts in the environment of non-low vowels. Furthermore, ES is found only where there is a pharyngealized coronal consonant /t̤, d̤, s̤, z̤, ð̤, r̤, ʕ̤/ or the pharyngealized back vowel /a/. In a suprasegmental account, however, such facts must be treated as accidental because the actual phonemic content of the syllable should be irrelevant (Younes 1982:40). More problematically, this approach grants the prosodic structure access to featural information that is assumed to be lower in the hierarchy, i.e., skipping over the intermediate segmental level of representation.

In this chapter, I characterize ES as a segmental process triggered or blocked by certain consonants and vowels. Still, a complete analysis of ES should not ignore the motivation beyond the suprasegmental account. While no other segmental account directly addresses this issue, the present account explains it by positing two separate domains for the application of ES: the prosodic word and the syllable.

### 3.1.2.2 The Vocalic Account

A standard segmental analysis regards emphasis as an inherent feature of a certain segment, which influences adjacent segments by means of coarticulation. However, the fact that emphasis is never an articulatory feature of only one segment makes it unclear whether consonants influence vowels or vice versa. In view of the extensive qualitative variation of the vowels, Khalafallah (1969) posits that emphasis as a feature is inherent in the vocalic system of Sa‘īdi Egyptian Arabic. This entails that all vowels have plain and emphatic counterparts, but no consonant has an underlying emphatic quality. This proposition is inappropriate for any Arabic dialect where there are, to my knowledge, no vowel contrasts apart from the low back /a/ vs. front /a/.<sup>1</sup> Zawaydeh (1999) argues against a vocalic account because, among other reasons, if a word does not contain pharyngealized coronals (or /a/), there would be no explanation for why no vowels in the word are pharyngealized.

Overall, Khalafallah (1969) tries to achieve economy by positing phonologically contrastive emphatic vowels, yet he fails to account for the limited distribution facts. While the logic behind this approach is not altogether flawed, economy should not be sought at such a high price. Economy is achieved in the present analysis by assuming that only the low vowel has split into plain and emphatic phonemes in what looks like

<sup>1</sup> Some other languages do contrast pharyngealized and plain vowels, such as the Khoesan language !Xóǝ (Traill 1985).

a weaker version of the vocalic account. Emphatic /a/ is the trigger of ES in words containing no emphatic consonant, replacing a large controversial set of “secondary emphatics”, as will be shown in the following section.

### 3.1.2.3 The Traditional Consonantal Account

Those who argue for a segmental analysis mostly regard emphasis as a consonantal feature. One of the most widely pursued approaches defines two classes of consonants as triggers of ES (e.g., Jakobson 1957, Watson 2002). The first class is the partially uncontroversial coronal emphatics including /t<sup>s</sup>, d<sup>s</sup>, s<sup>s</sup>, z<sup>s</sup>, ð<sup>s</sup>/. In items that contain one of these “primary” emphatics, instances of other emphatic consonants may be found in all positions and adjacent to all vowels. Such occurrences may be dubbed “conjunct secondary emphatics” (Harrell 1957), but these are not our concern since their surface forms are unarguably explained by emphasis spread.

On the other hand, this approach recognizes a class of secondary triggers where ES is documented in stems with no coronal emphatics. These are composed of labial, dorsal, and a few coronal segments that have the effect of lowering adjacent /a/ to /a/. The following is an exhaustive list of (independent) “secondary emphatics” that have been proposed for various Arabic dialects: /r<sup>s</sup>, l<sup>s</sup>, z<sup>s</sup>, n<sup>s</sup>, m<sup>s</sup>, f<sup>s</sup>, b<sup>s</sup>, p<sup>s</sup>, x<sup>s</sup>, k<sup>s</sup>/. The debate about these secondary emphatics concerns their phonological nature, their limited effect as triggers of ES, and the features that unify them. The important point is that while emphatic/non-emphatic contrasts involving the primary emphatics are found in all vocalic environments, contrasts involving the secondary emphatics are much more restricted (Younes 1994).

The coronal consonant /r<sup>s</sup>/ is considered the most prominent secondary emphatic because the others are both statistically rare and limited in distribution (Watson 2002: 275). As a result, generalizations about secondary emphatics are usually based on the behavior of /r<sup>s</sup>/, which calls them into question. Unlike other consonants in this class, /r<sup>s</sup>/ is not restricted to the neighborhood of /a/. Another difference is the de-emphasis of /r<sup>s</sup>/ in certain well-defined phonological environments (Younes 1994 with reference to Palestinian Arabic). In a limited number of Arabic dialects, emphatic /l<sup>s</sup>/ can be considered a separate phoneme, and it behaves like /r<sup>s</sup>/ in regard to its de-emphasis and its distribution with vowels.

In this chapter, I argue that /r<sup>s</sup>/ should be classified with the coronal “primary” emphatics where it occurs contrastively in a dialect of Arabic—e.g., CA. The coronal /l<sup>s</sup>/ may be classified similarly in BA. Regarding other labial and dorsal secondary emphatics, the standard (consonantal) account ignores the striking observation that they are always adjacent to a low vowel /a/. In my analysis, this fact is accounted for by positing /a/ as an underlying ES trigger specified for the emphatic feature, thus making fewer distinctions in the contrastive inventory. Sections 3.2 and 3.3 discuss the language-specific implications of these conclusions in Cairene and Baghdadi Arabic, and provide PSM-based autosegmental and optimality-theoretic analyses for the behavior of ES in the respective variety.

## 3.2 Emphasis Spread in Cairene Arabic

The core of this section concerns the nature of emphasis spread in Cairene Arabic and its consequences on the structure of the segment inventory. As is the case in many dialects of Arabic, ES in CA is regulated by an intricate set of phonological factors which have been the subject of much controversy in the literature, including the consonants that constitute underlying emphatics, the features needed to define them, the rules needed to describe their effect on neighboring segments, and the existence of opacity effects. This section resolves some of these controversial issues and provides a uniform representation of Cairene ES facts within the Parallel Structures Model.

Attempting to resolve the disputes about ES in an Arabic dialect faces numerous difficulties, most prominent of which are conflating dialectal data with the standard variety and among the sub-dialects within one geographical area. That being the case, it was felt imperative to collect fresh data that is both consistent and reliable. Eight informants (three males and five females, ranging between 23–54 years old, and all Cairo residents) were interviewed over 1-2 recording sessions, and the samples were analyzed using Praat 5.2.27. Seven out of the eight informants had university degrees while one was illiterate (used as a control). I asked the subjects to read words from a list and use them in sentences or answer questions in an interview format. Elicited words and phrases aimed to test potential participating segments (triggers, targets, and blockers) and potential domains of spread. Published data from various sources have also been used in this study, especially Harrell (1957), Schulte (1985), Watson (2002), and Woidich (2006a). All secondary data have been verified by two native speakers in addition to the author himself.

It is important to acknowledge the large degree of variation in the behavior of emphasis spread. In particular, the role of sociolinguistic factors in the production of emphasis has been the subject of much investigation. Regarding gender and social class variation, there seems to be an agreement that emphasis is more characteristic of masculinity and low social status, and that in females emphasis is less strongly pronounced (Kahn 1975, Royal 1985, Wahba 1996).<sup>2</sup> Regional differences within Egypt are quite large—e.g., between Cairo, Alexandria, and many parts of the Delta and Upper Egypt (Woidich 2006a:27)—sometimes leading to difficulties in characterizing the urban vernaculars of migration-attracting cities like Cairo (see Miller 2004). For instance, while ES is predominantly unblocked in Cairene, some speakers with a rural background exhibit a consistent blocking effect to rightward ES by certain segments. This has caused confusion in the literature, characterizing the blocking mechanism of ES as optional (Watson 2002:274) when in fact it is the internalization of two distinct grammars. Finally, stylistic variations also occur, sometimes with influences from Standard Arabic. In the process of data collection, I tried to control for these variables by: (i) locating both male and female speakers as informants, (ii) making sure they are natives of Cairo at least for one generation, (iii) clearly instructing them to use

<sup>2</sup> According to Woidich (2006a:27), exaggerated emphasis is very characteristic of hashish smokers.

their everyday language of communication, and (iv) re-recording several tokens if any influence from Standard Arabic is detected. In doing so, the current study provides a coherent and detailed analysis of native educated Cairene Arabic, and will not attempt to model influences from neighboring dialects nor sociolinguistic variation across the population. These issues will be left to future investigation.

Below I argue that triggers of ES in CA belong to one natural class of segments characterized by a V-place[dor] feature. This class includes the consonants /t̤, d̤, s̤, z̤, r̤/ in addition to the low back vowel /ɑ/. The characterization of /ɑ/ as an underlying trigger is a major departure from orthodox analyses, whereby the so-called secondary emphatics are underlyingly plain consonants that become targets of ES triggered by /ɑ/. These consonantal and vocalic triggers spread V-place[dor] bidirectionally to all segments in the prosodic word domain. The analysis suggests that the behavior of these segments under ES diagnoses inventory structure and featural makeup.

The discussion is organized as follows. Section 3.2.1 introduces the acoustic and articulatory correlates of emphatic triggers (compared to the behavior of uvulars and pharyngeals) and their effect on neighboring (target) segments within a specified domain. Section 3.2.2 presents the phonological behavior of ES in different domains and makes some important predictions about the phonologically contrastive inventory of CA with regard to the participating segments. Section 3.2.3 provides autosegmental representations for the process of ES and justifies feature specifications for each participating segment. And finally section 3.2.4 proposes an optimality-theoretic analysis of the assimilation pattern.

### 3.2.1 The Phonetics of Emphasis Spread in CA

The research on the phonetic aspects of emphasis in CA has generated a fair amount of disagreement. This section highlights the main findings of the most known studies and proves the validity of certain conclusions to the exclusion of others. I will specifically address three questions: (i) what constitutes the class of consonantal emphatic triggers? (ii) what acoustic effects do these consonants have on neighboring vowels? and (iii) what is the domain of spread?

#### 3.2.1.1 The Triggers of Emphasis Spread

The emphatic consonants of CA, /t̤, d̤, s̤, z̤, r̤/, are produced by “raising and backing the dorsum of the tongue concurrently with the primary dental or alveolar articulation so that the articulation is velarized or pharyngealized” (Abdel-Massih et al. 1979:76). The articulation may also involve slight lip protrusion and increased tension of the entire oral and pharyngeal musculature (Lehn 1963). All the articulatory studies done point to the fact that the place of primary constriction in the emphatics is alveolar, with the upper pharyngeal constriction being secondary (Schulte 1985:15).

Emphatic sounds should not be confused with the true pharyngeals /ħ/ and /ʕ/, which have primary constriction in the lower pharynx (ibid.). Moreover, pharyngeals do not induce coarticulation in the surrounding vowels as do the emphatics (Broselow



1976:41). /ħ/ and /ʕ/ may even be “pharyngealized” in the presence of an emphatic, where they exhibit significantly lower F<sub>2</sub>. On the other hand, the uvular consonant /q/ causes lowering or backing of all immediately preceding and following vowels. But unlike the long distance emphatic coarticulation, the effect is strictly local. And this makes it a clear case of phonetic enhancement resulting from /q/’s fairly back primary articulation. It seems only natural that there is no distinction phonetically between a pharyngealized and a non-pharyngealized /q/ (Youssef 2006:40).

### 3.2.1.2 The Targets and Domain of Emphasis Spread

Studies on CA seem to agree that the emphatic quality always extends over a stretch of segments. In particular, the occurrence of an emphatic consonant is automatically associated with a parallel effect on neighboring vowels. The high-mid front vowels are centralized; the back vowels are lowered; and the low vowels are backed (Abdel-Massih et al. 1979:77). The main acoustic cues of emphasis in vowels are lowering of F<sub>2</sub> (pertaining to the degree of backness) and sometimes raising of F<sub>1</sub> (pertaining to vowel height), or rather a narrowing of the difference between F<sub>1</sub> and F<sub>2</sub> frequencies (Schulte 1985). A particularly large drop in F<sub>2</sub> steady state frequencies appears to be a characteristic property of CA, compared to other dialects (Norlin 1987:38).

On one extreme, the low vowel /a(:)/ seems to have a special affinity for emphatic articulation; i.e., it exhibits a significant lowering of F<sub>2</sub> in emphatic contexts. On the other extreme, the back vowels /u(:), oo/ show the least distinction because their F<sub>2</sub> values are so low ordinarily that they cannot be further lowered by emphasis (al-Ani and el-Dalee 1983). Finally, the high-mid front vowels /i(:), ee/ show a fair amount of distinction, with clear F<sub>2</sub> lowering as well as F<sub>1</sub> raising. As for consonants targeted by emphasis, the effect is often detected in the consonant to vowel and vowel to consonant formant transitions vis-à-vis the plain contexts (Norlin 1987:13). But word-final consonants of a simple or a complex coda show no clear spectrographic evidence to support spread of the emphatic gesture (Schulte 1985:20–2). Be that as it may, these consonants must be realized with emphasis at least on the phonological level since, upon the addition of an affix, the feature spreads all through them and into attached affixes (see §3.2.2.2).

Contrary to most treatments in the literature, acoustic analysis of my recordings supports the view that both leftward and rightward spread of emphasis in Cairene is unblocked (*ibid.*, p.29), making all segments in the prosodic word domain potential targets. Seeing that the consonantal triggers /t<sup>ʕ</sup>, d<sup>ʕ</sup>, s<sup>ʕ</sup>, z<sup>ʕ</sup>/ have been the focus of every phonetic analysis to date, I will provide acoustic evidence that the controversial liquid emphatic /r<sup>ʕ</sup>/ triggers leftward and rightward ES in a word that includes an affix. The spectrogram in Figure 1 demonstrates an utterance of four syllables. The underlying emphatic consonant /r<sup>ʕ</sup>/ is located in the second syllable. And it appears that the whole utterance exhibits characteristics of backing.

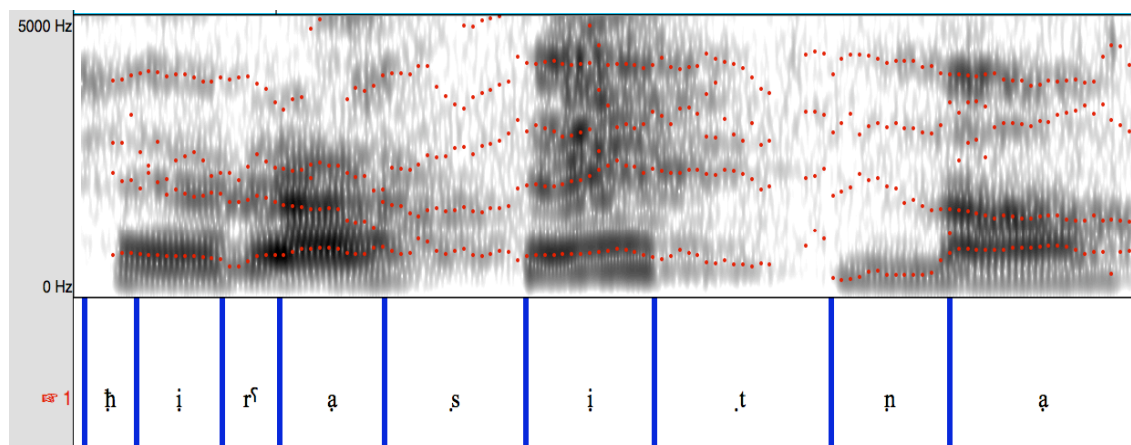


Figure 1. Spectrogram of the word /ħirʕaʕit-ŋa/ ‘our guards’ demonstrating a bidirectional effect of pharyngealization associated with /rʕ/ (37-year-old female speaker of CA)

If we compare the formant values of the vowels in Figure 1 to those of the corresponding vowels in the environment of plain /r/ (for the same speaker), we can identify the influence of emphatic context on vowel quality in CA. Lowering of  $F_2$  was verified acoustically for all vowels in this word regardless of their distance from the emphatic consonant. The vowel /a/ immediately following /rʕ/ has an  $F_2$  frequency of 1580 Hz, while /a/ next to a plain /r/ has an average  $F_2$  frequency of about 1850 Hz; hence, /a/ is backed. The last (affixal) vowel in the word is also backed, as shown in its low  $F_2$  frequency of 1440 Hz. On average, the  $F_2$  drop for /a/ amounts to 300–500 Hz, but no significant changes in  $F_1$  have been observed. The  $F_2$  frequency of /i/ drops as much as 1910 Hz next to emphatic /rʕ/ and to 2170 Hz in the third syllable (from about 2500 Hz next to plain /r/). A raising of  $F_1$  is also observed in /i/, from roughly 500 Hz in non-emphatic environments to 730 Hz and 780 Hz in the first and third syllables, respectively. On that account, /i/ is both centralized and lowered. The measurements are generally close to those of Schulte’s (1985:11) next to the obstruent emphatics, where  $F_2$  for /a/ is 1350 Hz (vs. 1950 Hz for plain /a/) and for /i/ is 1700 Hz (vs. 2250 Hz for plain /a/). The differences can be regarded as inter-speaker variation.

We conclude that emphasis is associated acoustically with a lowered  $F_2$  and, to a smaller extent, a raised  $F_1$  frequencies. One last remark concerns the alleged gradient descent of emphasis on distant targets. In the case of a target vowel /a/, the further it is from the trigger consonant, the higher degree of backing it receives (unexpected). As for /i/, the further it is from the trigger, the less degree of backing it receives.

### 3.2.2 Triggers and Domain of Emphasis Spread in CA

#### 3.2.2.1 Trigger Segments

An interesting observation about the surface inventory of CA is that all consonants except /q/ have emphatic counterparts, but most of these are found in very restricted vocalic environments. In fact, only the coronal emphatic consonants /tʕ, dʕ, sʕ, zʕ, rʕ/ can

appear in varying vocalic environments. They may exist essentially in the onset or coda of a syllable containing one of the long non-low vowels /i:, u:, ee, oo/ or a short high vowel /i, u/ and no other coronal emphatics in the word (1).

## (1) Coronal emphatic consonants next to non-low vowels

a.	<i>tʰi:f</i>	‘he fled’	<i>tʰi:h</i>	‘hurtle! MS’
	<i>tʰu:m</i>	‘bait’	<i>tʰo:ʔ</i>	‘hoop’
	<i>ʔutʰ</i>	‘tom cat’	<i>ħeetʰ</i>	‘wall’
b.	<i>zʰulm</i>	‘injustice’	<i>ʒizʰunn</i>	‘he suspects’
	<i>ʒeetʰ</i>	‘irritation’	<i>ħifizʰ</i>	‘he memorized’
	<i>ʒiħizʰ</i>	‘He delights’	<i>ʒibu:zʰ</i>	‘it malfunctions’
c.	<i>dʰi:f</i>	‘he weakened’	<i>dʰi:f</i>	‘get lost! MS’
	<i>dʰo:ʔ</i>	‘light’	<i>dʰeetʰ</i>	‘guest’
	<i>beedʰ</i>	‘eggs’	<i>ħo:ʔdʰ</i>	‘sink’
d.	<i>sʰiħ</i>	‘he woke up’	<i>sʰubħ</i>	‘morning’
	<i>sʰu:f</i>	‘wool’	<i>sʰo:m</i>	‘fast’
	<i>ħu:sʰ</i>	‘smear! MS’	<i>ħi:sʰ</i>	‘have fun! MS’
e.	<i>rʰubʔ</i>	‘quarter’	<i>rʰu:f</i>	‘roof’
	<i>rʰo:ħ</i>	‘soul’	<i>rʰu:ħ</i>	‘go! MS’
	<i>murʰ</i>	‘bitter’	<i>ʒu:rʰ</i>	‘get lost! MS’

Excluding /rʰ/ for the time being, an emphatic /tʰ, dʰ, sʰ, zʰ/ in a given root persists in all words of that root. Additionally, they contrast with their non-emphatic counterparts in minimal pairs (Harrell 1957:71), as exemplified in (2). All these distributional facts suggest that the presence or absence of emphasis is contrastive for the coronals /tʰ, dʰ, sʰ, zʰ, rʰ/, which spread emphasis to other segments in the word domain.

## (2) Contrasts involving emphatic vs. non-emphatic coronal consonants

<i>tʰi:f</i>	‘child’	<i>tif</i>	‘dregs’
<i>tʰi:m</i>	‘mud’	<i>tin</i>	‘figs’
<i>tʰu:b</i>	‘stones’	<i>tu:b</i>	‘repent MS’
<i>dʰi:l</i>	‘shade’	<i>dill</i>	‘guide! MS’
<i>sʰi:f</i>	‘zero’	<i>sifr</i>	‘book (of the Bible)’
<i>sʰi:m</i>	‘China’	<i>sin</i>	(letter name)
<i>sʰeetʰ</i>	‘summer’	<i>seef</i>	‘sword’
<i>sʰib-ħa</i>	‘strike her! MS’	<i>sib-ħa</i>	‘leave her! MS’
<i>ʒisʰi:ħ</i>	‘it crows (of a cock)’	<i>ʒisi:ħ</i>	‘it melts’
<i>bu:zʰ</i>	‘get corrupted! MS’	<i>bu:z</i>	‘muzzle’

These coronal emphatics may also exist in syllables containing a short or long back low vowel /ɑ(:)/.<sup>3</sup> And there is a large number of minimal pairs contrasting /t̤, d̤, s̤, z̤, r̤/ with /t, d, s, z, r/ in syllables containing a low vowel, as exemplified in (3). Such contrasts illustrate that /t̤, d̤, s̤, z̤, r̤/ are inherently distinct phonemes with a common emphatic feature.

(3) Additional contrasts involving emphatic vs. non-emphatic coronal consonants

a.	<i>t̤a:b</i>	‘it is cooked’	<i>ta:b</i>	‘he repented’
	<i>bat̤t̤</i>	‘ducks’	<i>batt</i>	‘he decided’
	<i>ʃat̤t̤a</i>	‘chili’	<i>ʃatta</i>	‘he put on winter clothes’
b.	<i>d̤ala:l</i>	‘backsliding’	<i>dala:l</i>	‘coquetry’
	<i>xad̤d̤</i>	‘he surprised’	<i>xadd</i>	‘cheek’
	<i>had̤am</i>	‘he digested’	<i>hadam</i>	‘he destroyed’
c.	<i>s̤abb</i>	‘he poured’	<i>sabb</i>	‘he insulted’
	<i>s̤a:m</i>	‘he fasted’	<i>sam</i>	‘poisonous’
	<i>bas̤s̤</i>	‘he looked’	<i>bass</i>	‘enough’
d.	<i>z̤ann</i>	‘he suspects’	<i>zann</i>	‘he nagged’
	<i>z̤a:hir̤</i>	‘obvious’	<i>za:hir</i>	(proper name)
	<i>ħa:fiz̤</i>	‘memorizing’	<i>ħa:fiz</i>	‘incentive’
e.	<i>r̤aff</i>	‘shelf’	<i>raff</i>	‘it twitched’
	<i>r̤a:mi</i>	(male name)	<i>rami</i>	‘throwing’
	<i>warr̤r̤-a:ni</i>	‘rear’	<i>warra:-ni</i>	‘he showed me’

If there is no emphatic /t̤, d̤, s̤, z̤, r̤/ in the word, any surface emphatic consonant is only found in words with a back low vowel, while its non-emphatic counterpart is not restricted to any vocalic environment. I take the fact that all consonants are emphatic in words containing a back low vowel /ɑ/ as evidence that this vowel has an underlying emphatic feature. This supports Ghazeli’s (1977:9) assertion that some modern Arabic dialects have created a polarization in the vowel system leading to a split into phonemic /ɑ/ and /ɑ/. Norlin (1987:57–9) provides phonetic basis for this type of split in Cairene.

The characterization of /ɑ/ as an underlying trigger rules out traditional claims for contrastive secondary emphatics /l̤, m̤, f̤, b̤, x̤, k̤/ (see §3.1.2.3 above).<sup>4</sup> (4a) lists CA words with surface emphatic /l̤, m̤, f̤, b̤, x̤, k̤/. The observation that each of these consonants is always adjacent to a back low /ɑ/ (Harrell 1957:74) is evidence that the latter is the trigger of ES in all these occurrences. There is also a limited number of

<sup>3</sup> The examples below distinguish a surface emphasized (originally front) low vowel /ɑ(:)/ from the phonetically identical back low vowel /ɑ(:)/. This is a conventional device that will be justified shortly.

<sup>4</sup> Consider the extreme case of Maltese, where the phonemic split between /ɑ/ and /ɑ/ resulted from the total loss of emphatic consonants (Comrie 1991:237).

minimal pairs (4b) involving /a/~a/ contrasts, with no coronal emphatics in the word domain (Woidich 2006a:24). Note that the vast majority of these forms are loanwords that are not fully incorporated into the consonantal root system of CA (cf. Younes 1982:70). That being the case, it is not problematic that they retain the underlying vowel /a/ under productive morphological alternations. The /a/~a/ alternations are almost completely predictable in other verbal and nominal paradigms.

(4) CA words with non-coronal “secondary emphatics”

a.	<i>ʔalla:h</i>	‘God’	<i>walla</i>	‘by God’
	<i>majj-a</i>	‘water’	<i>ma:ma</i>	‘mom’
	<i>ʔumma:l</i>	‘of course’	<i>lamba</i>	‘lamp’
	<i>ʔabb</i>	‘father’	<i>ba:ba</i>	‘dad’
	<i>ʔabla</i>	‘ma’am’	<i>ʔaxx</i>	‘brother’
	<i>faxm</i>	‘lavish’	<i>mufaxxam</i>	‘emphasized’
	<i>ka:ki</i>	‘cackle’	<i>ka:ka</i>	‘persimmon’
b.	<i>ba:ba</i>	‘dad’	<i>ba:ba</i>	(name of a Coptic month)
	<i>ʔabb</i>	‘father’	<i>ʔabb</i>	‘it floated’
	<i>ʔabla</i>	‘ma’am’	<i>ʔabla</i>	‘before’
	<i>jamma</i>	‘mother!’	<i>jamma</i>	‘direction’
	<i>majjit-ħa</i>	‘her water’	<i>majjit-ħa</i>	‘her dead one’
	<i>ka:ki</i>	‘cackle’	<i>ka:ki</i>	‘khaki’
	<i>ʔalla</i>	‘God’	<i>ʔalla</i>	(surprise particle)
	<i>walla</i>	‘by God’	<i>walla</i>	‘or’
	<i>ħalla</i>	‘how wonderful!’	<i>ħall-a</i>	‘appearing FS’

This conclusion is further reinforced by the fact that a foreign word with a back low vowel that is borrowed into CA is interpreted as emphatic (Harrell 1957:79, fn.26). Thus in borrowing the Italian word *lampa*, for example, the Italian vowel /a/ was mapped onto the most similar phoneme /a/ which is expected in CA in emphatic contexts; hence the output *lamba*. Furthermore, the presence of a back low vowel in the neighborhood of coronal consonants in the source language is taken by native speakers of CA as a signal that such consonants are emphatic (Younes 1994:230), as the data in (5) suggests.<sup>5</sup> Here the historical change to a consonantal trigger, usually reflected in the orthography, was originated by a vocalic trigger since in the source language the consonants are clearly non-emphatic.

<sup>5</sup> An anonymous reviewer once pointed out that for many consonants, the major cues to their features rests in the vocalic portions—the major cues to place of articulation of stops, for example, are found in the vocalic formant transitions. It is therefore plausible that upon hearing what sounds like an emphatic vowel allophone, Arabic listeners will assume that this emphasis indicates the presence of a nearby underlyingly emphatic consonant. To test this more directly, let us consider an English word like *sun*, often pronounced as *sʌn* by Arabic second language learners. In this instance, the back vowel /ʌ/ has caused the coronal /s/ to be erroneously interpreted as emphatic (Haddad 1984:302).

## (5) Cairene Loanwords with emphatic consonants

<i>busʔa</i>	‘post’	<i>baʔa:ʔisʔ</i>	‘potatoes’
<i>sʔalatʔa</i>	‘salad’	<i>sʔaloʔn</i>	‘saloon’
<i>baʔaʔaloʔn</i>	‘pants’	<i>baʔtu</i>	‘coat’
<i>biʔiʔanja</i>	‘Britain’	<i>ʔiʔalja</i>	‘Italy’

Many occurrences of ES include multiple potential triggers. On the one hand, roots with more than one of /t, d, s, z, tʔ, dʔ, sʔ, zʔ/ have either both consonants realized as emphatic or both as non-emphatic. And in all emphatic cases, “it seems that the emphatic property (in many dialects of Arabic) either spreads from the rightmost /tʔ, dʔ, sʔ, zʔ/ or that there is reduplication” (Bellem 2007:274), as exemplified in (6a–b). In some of these examples, the Standard Arabic orthography identifies only one consonant as emphatic and the other as plain, and Arabic speakers tend to misspell such words with two emphatic letters. Even if the orthography is phonemic, there are no synchronic alternations to prove that one of these consonants is non-emphatic. Hence, both coronal consonants will be marked as underlyingly emphatic here (leading to homophonous words like *sʔoʔtʔ* ‘sound/whip’) except where there are alternations (e.g. in affixes, as shown in §3.2.2.2). I follow the same convention when the combination contains /rʔ/ and one or more of /tʔ, dʔ, sʔ, zʔ/, since in such words the de-emphasis of /rʔ/ does not take place on the surface (§3.2.2.3). As for words that contain an emphatic coronal consonant and a back low vowel, CA speakers will assume an underlying consonantal trigger, knowing that these low vowels may be deleted or changed into other non-low vowels by means of nonconcatenative alternations (6c). Only in the absence of /tʔ, dʔ, sʔ, zʔ, rʔ/ is the back low vowel /a/ considered the trigger of ES.

## (6) Multiple potential /tʔ, dʔ, sʔ, zʔ, rʔ/ triggers of ES

a.	<i>tʔarʔtʔurʔ</i>	‘conical cap’	<i>tʔaftʔaf</i>	‘open-sided bus’
	<i>baʔsʔbaʔsʔ</i>	‘he ogled’	<i>sʔaʔsʔaʔ</i>	‘he became alert’
	<i>rʔaʔrʔaʔ</i>	‘he sprawled’	<i>rʔaʔrʔaʔ</i>	‘he caused to quiver’
	<i>ʔadʔʔadʔ</i>	‘he gnawed’	<i>ʔazʔʔazʔ</i>	‘he became plump’
b.	<i>tʔalsʔim</i>	‘he jammed’	<i>baʔa:ʔisʔ</i>	‘potatoes’
	<i>dʔufdʔaʔa</i>	‘frog’	<i>dʔaʔatʔ</i>	‘he pressed’
	<i>baʔaʔtʔ</i>	‘he pleased’	<i>sʔandʔal</i>	‘sandals’
	<i>zʔaʔtʔatʔ</i>	‘he became elated’	<i>tʔuzʔzʔ</i>	‘so what!’
c.	<i>tʔa:l</i>	‘he grew tall’	<i>tʔu:l</i>	‘length’
	<i>dʔamm</i>	‘he joined’	<i>dʔum</i>	‘join! MS’
	<i>sʔa:tʔ</i>	‘he became famous’	<i>sʔi:tʔ</i>	‘fame’

To summarize the discussion so far, the distribution of surface emphatic consonants with low and non-low vowels has led to many claims about the underlying nature of both vowels and consonants. I have argued for one natural class of ES triggers that includes the segments /tʔ, dʔ, sʔ, zʔ, rʔ, a/. This indicates two significant departures from

traditional treatments of emphasis spread. One is treating /r<sup>s</sup>/ as primarily an emphatic consonant despite its unique behavior as ES trigger (Younes 1993:123). The other is the characterization of /a/ as an underlying trigger to the exclusion of the so-called secondary emphatics. This is not only the most economical interpretation of the facts, but it is also independently justifiable.

### 3.2.2.2 The Domain of Emphasis Spread

Cairene displays long distance assimilation of the emphatic feature within a certain domain triggered by a segment that bears this feature contrastively. Emphasis spread is a bidirectional process that involves no opaque segments for CA speakers, whereas emphatic /r<sup>s</sup>/ is de-emphasized by adjacent high vowels. This section examines the role of morphology in ES, triggered by /t<sup>s</sup>, d<sup>s</sup>, s<sup>s</sup>, z<sup>s</sup>, r<sup>s</sup>, a/, in order to determine its accurate domain of application in CA.

Most treatments of ES specify a stem word domain: one without any nominal, adjectival, or verbal prefixes or suffixes.<sup>6</sup> The following examples exhibit the effect of different emphatic triggers on monosyllabic, disyllabic, and trisyllabic stem words of different templates.<sup>7</sup> Note that ES applies leftwards or rightwards (or both) depending on the position of the underlying emphatic trigger in the word. Targets are depicted with a dot underneath the symbol, or above symbols with descenders, e.g., /ǧ/.

#### (7) a. ES in mono-syllables

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
CV(V)C	ʔaxx	‘brother’	r <sup>s</sup> abb	‘god’
	xad <sup>s</sup> d <sup>s</sup>	‘he startled’	n <sup>s</sup> us <sup>s</sup> s <sup>s</sup>	‘half’
	t <sup>s</sup> i:n	‘mud’	s <sup>s</sup> a:n	‘he kept safe’
	b <sup>s</sup> e <sup>s</sup> d <sup>s</sup>	‘eggs’	b <sup>s</sup> az <sup>s</sup>	‘it malfunctioned’
CVCC	t <sup>s</sup> i:fl	‘infant’	f <sup>s</sup> axm	‘luxurious’
	f <sup>s</sup> as <sup>s</sup> l	‘class’	ʃ <sup>s</sup> ad <sup>s</sup> m	‘bones’
	ʃ <sup>s</sup> ahr <sup>s</sup>	‘month’	ʃ <sup>s</sup> axs <sup>s</sup>	‘person’

#### b. ES in bi-syllables

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
CVCV	t <sup>s</sup> afa	‘he put out’	s <sup>s</sup> ihi	‘he woke up’
	m <sup>s</sup> ad <sup>s</sup> a	‘he signed’	w <sup>s</sup> it <sup>s</sup> i	‘it decreased’
CVCVC	z <sup>s</sup> alam	‘he wronged’	s <sup>s</sup> ah <sup>s</sup> h <sup>s</sup> ah <sup>s</sup>	‘he corrected’
	d <sup>s</sup> ajja <sup>s</sup> ʔ	‘he lost’	r <sup>s</sup> abb <sup>s</sup> ʔ	‘he crossed (legs)’
	ʔat <sup>s</sup> a <sup>s</sup> ʔ	‘he cut’	y <sup>s</sup> ad <sup>s</sup> ʔab	‘anger’
	ʃ <sup>s</sup> at <sup>s</sup> ʔal	‘he delayed’	ʃ <sup>s</sup> ufat <sup>s</sup>	‘signs’
	m <sup>s</sup> ayas <sup>s</sup>	‘stomachache’	h <sup>s</sup> amad <sup>s</sup>	‘it became sour’

<sup>6</sup> A couple of studies limit the domain of ES in CA to the syllable, with the possibility to spread to neighboring syllables in certain cases (see Broselow 1976:42, Abdel-Massih et al. 1979:76).

<sup>7</sup> As a means of simplification, one consonant (C) in a template may also stand for a geminate.

### 3. EMPHASIS SPREAD

CVVCVC	<i>ṣʕa:ħib</i>	‘friend’	<i>ṣʕa:liħ</i>	‘he reconciled’
	<i>ṭʕa:lib</i>	‘student’	<i>ḍʕa:ṛib</i>	‘hitting’
	<i>ʔa:ṛiṣ</i>	‘pinching’	<i>ḅa:ʒiẓ</i>	‘spoiled’
CVCVVC	<i>ḍʕa:ʕi:f</i>	‘weak’	<i>ṣʕaba:ħ</i>	‘morning’
	<i>ṭulla:b</i>	‘students’	<i>ṛumma:n</i>	‘pomegranate’
	<i>ḅuħu:ṛ</i>	‘seas’	<i>ṇuḍʕa:f</i>	‘clean PL’
	<i>ḅaṭṭi:x</i>	‘watermelon’	<i>ʔumma:l</i>	‘of course’
	<i>ʔami:ṣ</i>	‘shirt’	<i>ħaj̣ja:ṭ</i>	‘tailor’
CVCCV(V)C	<i>ṣʕanḍʕal</i>	‘sandals’	<i>ħawħaw</i>	‘he barked’
	<i>ṭʕalṣim</i>	‘he jammed’	<i>ṭʕaṛmaħ</i>	‘he did carelessly’
	<i>ħaṛṭu:f</i>	‘cartridge’	<i>ḅalbu:ṣ</i>	‘stark naked’
	<i>ṣulṭa:n</i>	‘sultan’	<i>ṛimṛa:m</i>	‘scavenging person’
c. ES in tri-syllables				
<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
CVCVCV	<i>ʕabaṭʕa</i>	‘idiots’	<i>ħuṛʕama</i>	‘generous PL’
	<i>ʕuẓʕama</i>	‘great PL’	<i>ẓuṛʕafa</i>	‘pleasant PL’
CVCVVCVC	<i>ħaṛʕa:ʒiṭ</i>	‘maps’	<i>f̣awa:ṣil</i>	‘partitions’
	<i>ʕawa:ṭif</i>	‘emotions’	<i>ṭʕala:ṣim</i>	‘cryptic symbols’
	<i>ṣʕana:ḍil</i>	‘sandals’	<i>ṣʕawa:biʕ</i>	‘fingers’
CV(C)CVCVVC	<i>ṭʕaẉaḅiṛ</i>	‘queues’	<i>ṛʕaḅawa:n</i>	‘ambler’
	<i>ṣʕaẉami:l</i>	‘screws’	<i>ʕaṣʕafiṛ</i>	‘sparrows’
	<i>ʔaṛʕami:ṭ</i>	‘Nile catfish’	<i>laḅali:ṭ</i>	‘jellylike substance’
	<i>ṣʕaẉlaḡa:n</i>	‘scepter’	<i>ḅaṛḅaṭʕoṣ</i>	‘baby overall’

Emphasis in Cairene spreads into any and all attached nominal, adjectival, and verbal suffixes, both single or multiple (Woidich 2006a:25).<sup>8</sup> This is regardless of whether the emphatic trigger is in word-initial or word-final position. The sets of data in (8) are classified according to the type of suffix. I concentrate on suffixes that include a low vowel /a/ in order to show clear audible backing effect on the vowel, even without the need for acoustic analysis. Note that no suffixes or prefixes in any dialect of Arabic contain an underlying emphatic consonant.

<sup>8</sup> Watson (2002:275) claims that certain prefixes and suffixes—all including the vowel /i/—are not affected by ES. Schulte (1985:28), however, argues that spreading emphasis is obligatory into prefixes, but optional into suffixes. Moreover, she notes the existence of another sub-dialect of CA wherein the domain of ES is more restricted, and does not include any suffixes (ibid., p.24). Both of these observations need to be revised. The actual difference in this other sub-dialect (influenced by rural features) is that ES is blocked by non-tautosyllabic //i//-realizations. Although Schulte denies the existence of any opaque segments to ES, many of the examples she cites to the “restricted domain” involve blockage in the syllable prior to the suffix or in the suffix itself.



## (8) Emphasis spread into suffixes

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
<i>a. nominal</i>				
-a:t FPL	<i>fārʕajʃ-a:t</i>	‘butterflies’	<i>sʕinaʃ-a:t</i>	‘industries’
	<i>xajʃatʃ-a:t</i>	‘tailors’	<i>naʃatʃ-a:t</i>	‘activities’
-a:ti FPL	<i>mʕitʕabbil-a:ti</i>	‘drummer’	<i>mibʕasʕasʃ-a:ti</i>	‘flirt’
-a FS	<i>sʕija:n-a</i>	‘maintenance’	<i>ʕarʕabijj-a</i>	‘car’
	<i>beedʃ-a</i>	‘egg’	<i>maħfazʃ-a</i>	‘wallet’
-a:ja	<i>baʕʕal-a:ja</i>	‘an onion’	<i>batʕatʕʕ-a:ja</i>	‘a potato’
	<i>ʔamarʃ-a:ja</i>	‘moonlight’	<i>buṛʕuʔan-a:ja</i>	‘an orange’
<i>b. possessive</i>				
-na 1 PL	<i>tʕarʕiʔ-na</i>	‘our way’	<i>ʔablit-na</i>	‘our miss’
-ak 2 MS	<i>ʕimarʕt-ak</i>	‘your building’	<i>majjit-ak</i>	‘your water’
-ha 3 FS	<i>sʕjam-ha</i>	‘her fasting’	<i>dʕamirʃ-ha</i>	‘her conscience’
----	<i>maħfazʃ-it-ha</i>	‘her wallet’	<i>dirʕasa:t-ak</i>	‘your studies’
<i>c. adjectival</i>				
-a FS	<i>zʕarʕi:f-a</i>	‘pleasant FS’	<i>tʕajjib-a</i>	‘kind FS’
	<i>rʕahib-a</i>	‘terrific FS’	<i>sʕahih-a</i>	‘correct FS’
	<i>fadʕ-a</i>	‘empty FS’	<i>ʕawi:sʃ-a</i>	‘difficult FS’
-a:n	<i>zawrʃ-a:n</i>	‘choking MS’	<i>ħajrʃ-a:n</i>	‘perplexed MS’
	<i>ʕaltʃ-a:n</i>	‘mistaken MS’	<i>ʕatʕ-a:n</i>	‘thirsty MS’
	<i>ħarʕʃ-a:n</i>	‘hot MS’	<i>xarʕb-a:n</i>	‘broken down MS’
-a:ni	<i>wuʕʕʃ-a:ni</i>	‘middle’	<i>ʔabjadʃ-a:ni</i>	‘fair-complexioned’
	<i>ʔaʕʔarʃ-a:ni</i>	‘blondish’	<i>farʕad-a:ni</i>	‘alone’
-a:wi	<i>tʕantʃ-a:wi</i>	‘from Tanta’	<i>baħrʃ-a:wi</i>	‘from Biheera’
----	<i>ʕarʕʃ-an-ijja</i>	‘vicious FS’	<i>ʕatʕ-a:n-a</i>	‘thirsty FS’
<i>d. verbal (subject)</i>				
-na 1 PL	<i>tʕiliʕ-na</i>	‘we went up’	<i>fadʕdeʕ-na</i>	‘we emptied’
-ti 2 FS	<i>tʕabaʕ-ti</i>	‘you FS cooked’	<i>dʕaʕatʃ-ti</i>	‘you FS pressed’
-tu 2 PL	<i>dʕajjaʕ-tu</i>	‘you PL lost’	<i>sʕahjin-tu</i>	‘you PL ignored’
-u 3 PL	<i>ʔabadʃ-u</i>	‘they got paid’	<i>zʕaharʃ-u</i>	‘they appeared’
<i>e. verbal (object)</i>				
-na 1 PL	<i>dʕarʕab-na</i>	‘he hit us’	<i>fadʕaħ-na</i>	‘he disgraced us’
-ak 2 MS	<i>ʕawwarʃ-ak</i>	‘he hurt you’	<i>zʕalam-ak</i>	‘he wronged you’
-ha 3 FS	<i>tʕabaħ-ħa</i>	‘he printed it’	<i>fasʕal-ħa</i>	‘he separated it’
----	<i>dʕarʕab-tu:-na</i>	‘you PL hit us’	<i>ħafazʃ-n-a:k</i>	‘we memorized you’
	<i>garʕab-u:-ħa</i>	‘they tried it FS’	<i>baʕwazʃ-ti:-ħa</i>	‘you FS spoiled it’

Just like suffixes, emphasis spreads into one or more prefixes attached to an emphatic stem (Schulte 1985:27).<sup>9</sup> Inflectional prefixes in CA are restricted to verbs (to mark person, tense, or negation), while derivational prefixes can be nominal or adjectival. In the latter group, it may be difficult to identify morpheme boundaries when a level-one process involves a prefix in addition to a change in the stem template, as in the passive participle *maʔwlu:d* ‘born’ (Watson 2002:154). To resolve these ambiguities, I assume the first consonantal radical of a root to always indicate the beginning of the stem and whatever precedes it is a prefix, as demarcated in (9).<sup>10</sup> The data illustrate the spread of emphasis into different types of prefixes and into words containing both prefixes and suffixes. As a side note, Schulte (1985:28) reports that labial /b/ and /m/, which are common in prefixes, have a similar coarticulatory effect to ES on adjacent vowels (lower F<sub>2</sub>). However, this effect is much weaker than in ES, so the difference in vowel quality in, for example, *ma-* vs. *ma-* is clearly maintained.

## (9) Emphasis spread into prefixes

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
a. <i>perfective</i>				
<i>ʔa-</i> 1SG	<i>ʔa-zʔar<sup>s</sup></i>	‘I emerge’	<i>ʔa-tʔalsʔaʔ</i>	‘I work carelessly’
<i>ji-</i> 3 MS	<i>ji-ʔus<sup>s</sup></i>	‘he cuts’	<i>ji-ħdʔim</i>	‘he digests’
b. <i>imperfective</i>				
<i>ba-</i> 1SG	<i>ba-ħfʔaz<sup>s</sup></i>	‘I memorize’	<i>ba-tʔlaʔ</i>	‘I go up’
<i>bin-</i> 1 PL	<i>bin-rʔaddid</i>	‘we echo’	<i>bin-utʔlub</i>	‘we demand’
<i>bit-</i> 2 FS	<i>bit-dʔallim</i>	‘it gets dark’	<i>bit-sʔannaf</i>	‘she classifies’
c. <i>future</i>				
<i>ħa-</i>	<i>ħa-tʔaf</i>	‘I’ll flee’	<i>ħa-ħfʔaz<sup>s</sup></i>	‘I’ll memorize’
	<i>ħa-tusʔbur<sup>s</sup></i>	‘you’ll forbear’	<i>ħa-nukʔur<sup>s</sup></i>	‘we’ll get fed up’
----	<i>ba-krʔah-ħa</i>	‘I hate her’	<i>ʔa-sʔalih-ħa</i>	‘I reconcile with her’
	<i>ħa-dʔajjaʔi:-na</i>	‘you’ll ruin us’	<i>ħa-tinʔitʔu:-na</i>	‘you’ll madden us’
d. <i>negative</i>				
<i>ma-</i> <i>f</i>	<i>ma-batʔlubʔ</i>	‘I don’t ask’	<i>ma-jiḏrʔabu:f</i>	‘they don’t hit’
	<i>ma-zʔalamʔ</i>	‘he didn’t wrong’	<i>ma-sʔahitʔ</i>	‘she didn’t wake up’
	<i>ma-ddaħrʔaḡna:f</i>	‘we didn’t roll’	<i>ma-ʔabadʔ</i>	‘he didn’t get paid’

<sup>9</sup> In his survey of Northern Palestinian and Cairene Arabic, Younes (1993) claims some inconsistency in the emphatic pronunciation of the low vowel of certain prefixes. His informant alternates between a back and a front pronunciation, even of the same word in some cases.

<sup>10</sup> This signals two active “morphemes” in such level-one processes: a stem-external morpheme (affix) and a stem-internal morpheme (defined by the templatic pattern and/or the vocalic melody) (Ratcliffe 1990). Note that this may lead to a situation where the stem is not independently syllabifiable or even meaningful (Watson 2002:130). Section 5.2.2.1 provides ground for this kind of parsing.

e. *nominals*

<i>ta-</i>	<i>ta-ndʔi:f</i>	‘cleaning’	<i>ta-sʔarʔu:f</i>	‘behavior’
	<i>ta-xli:sʔ</i>	‘finishing’	<i>ta-bwi:zʔ</i>	‘spoiling’
<i>ʔa-</i>	<i>ʔa-tʔa:n</i>	‘tons’	<i>ʔa-sʔa:b</i>	‘friends’
	<i>ʔa-ʔba:tʔ</i>	‘Copts’	<i>ʔa-nʔa:dʔ</i>	‘debris’

f. *adjectival*

<i>ʔa-</i>	<i>ʔa-bjadʔ</i>	‘white’	<i>ʔa-ħmarʔ</i>	‘red’
	<i>ʔa-smarʔ</i>	‘brown’	<i>ʔa-sʔarʔ</i>	‘yellow’
<i>ma-</i>	<i>ma-zʔu:m</i>	‘oppressed’	<i>ma-sʔu:b</i>	‘crucified’
	<i>ma-wdʔu:ʔ</i>	‘topic’	<i>ma-dʔu:b</i>	‘beaten’
	<i>ma-nʔu:tʔ</i>	‘irritated’	<i>ma-ʃkurʔ</i>	‘thanked’

g. *combinations*

<i>ʔa-ħmarʔ-a:t</i>	‘shades of red’	<i>ta-xfidʔ-a:t</i>	‘discounts’
<i>ma-zʔu:m-a</i>	‘oppressed FS’	<i>ʔa-sʔa:b-a:k</i>	‘your MS friends’
<i>ma-wdʔu:ʔat-na</i>	‘our topics’	<i>ma-ʃrʔub-at-ħa</i>	‘her drinks’

Before stems containing an emphatic trigger, the definite article prefix *l-* appears emphatic whether or not it undergoes assimilation to the following coronal consonant (see §2.2.1.1). Watson notes that in the case of *l*-assimilation, the target is realized with emphasis irrespective of whether it is adjacent to an underlying emphatic or to one that is emphatic by virtue of ES (2002:274–5), as shown in (10b–c). This is evidence that emphasis spreads into prefixes independently of other assimilations.

## (10) ES into the definite article prefix (non-assimilated or assimilated)

a.	<i>ʔil-bidʔa:ʔa</i>	‘the merchandise’	<i>ʔil-ħadʔm</i>	‘the digestion’
	<i>ʔil-xatʔarʔ</i>	‘the danger’	<i>ʔil-ʃawadʔ</i>	‘the compensation’
	<i>ʔil-ʔe:zʔ</i>	‘the irritation’	<i>ʔil-fi:sʔa:l</i>	‘the bargaining’
	<i>ʔil-watʔan</i>	‘the homeland’	<i>ʔil-ʃaba:ʔo:ra</i>	‘the lamp’
b.	<i>ʔitʔ-tʔiba:ʔa</i>	‘the printing’	<i>ʔitʔ-tʔim</i>	‘the mud’
	<i>ʔidʔ-dʔaħijja</i>	‘the victim’	<i>ʔidʔ-dʔe:ʔ</i>	‘the guest’
	<i>ʔisʔ-sʔubħ</i>	‘the morning’	<i>ʔisʔ-sʔo:ba</i>	‘the greenhouse’
	<i>ʔizʔ-zʔulm</i>	‘the injustice’	<i>ʔizʔ-zʔa:bitʔ</i>	‘the officer’
	<i>ʔirʔ-rʔaħma</i>	‘the mercy’	<i>ʔirʔ-rʔu:mi</i>	‘the Greek’
c.	<i>ʔi{k}-kʔo:ra</i>	‘the ball’	<i>ʔiʒ-ʒa:ntʔ</i>	‘wheel-rim’
	<i>ʔi{g}-gʔarʔab</i>	‘the scabies’	<i>ʔif-ʃitʔa:m</i>	‘the devil’
	<i>ʔin-nadʔa:fa</i>	‘the cleanliness’	<i>ʔil-laʔa:fa</i>	‘the charm’
	<i>ʔit-ta-wa:dʔu:ʔ</i>	‘the humility’	<i>ʔit-tʔo:ra</i>	‘the bull’

Some accounts claim that emphasis in CA may extend to adjacent words in the phrase domain, but only subject to strict locality conditions (Woidich 2006a:26) and subject to the speed and formality of the utterance (Broselow 1976:46). First, if a word-initial

emphatic trigger is adjacent to a plain coronal, the latter will be realized with emphasis (§2.2.2.4).<sup>11</sup> Second, if a word-initial or word-final emphatic trigger is syllabified with the preceding or following vowel of another word, it will spread emphasis into the adjacent syllable as exemplified in (11a). Finally, Watson (2002:274) notes that in certain phrases invoking the name of God, emphasis optionally targets larger groups of segments in the preceding word. These phrases, however, are learned as chunks from religious contexts and may be abbreviated as shown in (11b). As a consequence, the word boundaries are ambiguous.

## (11) Spread of emphasis across the word boundary

- a. *ʔami:na* (proper name) + *tʔiwj:l-a* ‘tall’ → *ʔamiṇa tʔiwj:l-a* ‘Amina is tall’  
*ʕanda-ha* ‘she has’ + *dʔifirʔ-a* ‘plait’ → *ʕandaḥa dʔfirʔ-a* ‘she has a plait’  
*baʔee-na* ‘we became’ + *sʔuḥa:b* ‘friends’ → *baʔeeṇa sʔḥa:b* ‘we became friends’  
*ḥazʔʔ* ‘luck’ + *ʔil-ʕawa:lim* ‘the cantatrices’ → *ḥa.zʔʔ il.ʕawa:lim* ‘luck of the devil’
- b. *ʔin ʕa: ʔalla:h* ~ *ʔinʕalla* ‘God willing’  
*ma ʕa: ʔalla:h* ~ *maʕalla* ‘fantastic!’  
*ʕala alla:h* ~ *ʕalalla* ‘up to God’  
*ʕa: ʔalla:h* ~ *ʕalla* ‘Oh God! ~ hurry up!’  
*ʕubḥa:n alla:h* ~ *ʕubḥaṇalla:* ‘Hallelujah’  
*kaʕa lla ʕʕarʔʔ* or *la ʕamaḥ alla:* ‘God forbid’

To reiterate the point of this section, emphasis spread in CA is triggered by /tʔ, dʔ, sʔ, zʔ, rʔ, a/, and it applies obligatorily to the prosodic word domain. A syllable containing the emphatic trigger is necessarily realized with emphasis, even beyond the prosodic word domain. ES is a bidirectional process that functions as the union of two leftward and rightward spreading mechanisms. In the predominant variety of Cairene, there are no opaque segments except in the case of emphatic /rʔ/.

## 3.2.2.3 De-emphasis of /rʔ/

Cantineau (1960) asserts that the Old Arabic contrast between emphatic /rʔ/ and plain /r/ is maintained in most modern Arabic dialects (p.49). In CA, a non-emphatic /r/ is not always predictable from the phonological environment, and hence two separate phonemes must be postulated in order to handle all the data (Schulte 1985:33). These two phonemes are distinguished by a number of minimal pairs (3e). Recall also from §3.2.2.1 that /rʔ/ triggers rightward and leftward ES, and that non-tautosyllabic //i//-realizations do not block ES from /rʔ/ in both directions (but see Watson 2002:275), as exemplified in (12a–b).

<sup>11</sup> In some of these instances, emphasis may spread to the preceding vowel too (Watson 2002:274), but the influence is acoustically less salient and may vary a lot even for an individual speaker. I suggest that this is only phonetic coarticulation, since it rarely affects the entire syllable.

- (12) ES from /r<sup>s</sup>/ with non-tautosyllabic //i//-realizations to its right or left
- |    |                             |                    |   |                           |
|----|-----------------------------|--------------------|---|---------------------------|
| a. | <i>r<sup>s</sup>ā:qil</i>   | ‘man’              | <i>r<sup>s</sup>ā:qil-ħa</i>            | ‘her man’                 |
|    | <i>r<sup>s</sup>ābi:f</i>   | ‘spring’           | <i>r<sup>s</sup>ābi:f-ŋa</i>            | ‘our spring’              |
|    | <i>r<sup>s</sup>āzi:ŋ-a</i> | ‘self-composed FS’ | <i>r<sup>s</sup>āji:d-a</i>             | (female name)             |
|    | <i>r<sup>s</sup>uma:d-i</i> | ‘grey’             | <i>ta-r<sup>s</sup>āħi:l-a</i>          | ‘gang of casual laborers’ |
| b. | <i>ʔir<sup>s</sup>a:n</i>   | ‘Iran’             | <i>m<sup>s</sup>ir<sup>s</sup>abbā</i>  | ‘jam’                     |
|    | <i>dir<sup>s</sup>a:s-i</i> | ‘study-related’    | <i>ʔir<sup>s</sup>a:f-i</i>             | ‘sail-related’            |
|    | <i>ħir<sup>s</sup>a:s-a</i> | ‘guarding’         | <i>q<sup>s</sup>ir<sup>s</sup>a:ħ-a</i> | ‘surgery’                 |
|    | <i>buħeer<sup>s</sup>-a</i> | ‘lake’             | <i>ʔaxir<sup>s</sup>-aŋ</i>             | ‘finally’                 |
|    | <i>wiẓar<sup>s</sup>-a</i>  | ‘ministry’         | <i>ʔiṣṭi-ḥmar<sup>s</sup></i>           | ‘occupation’              |

I have treated /r<sup>s</sup>/ as a contrastive coronal emphatic in CA. However, /r<sup>s</sup>/ is different from the other contrastive emphatics /t<sup>s</sup>, d<sup>s</sup>, s<sup>s</sup>, z<sup>s</sup>/ because it occurs with a more limited set of vowels (Harrell 1957:72). It may be preceded by any vowel, but it may only be followed by the back vowels /ɑ(:), u(:), oo/ in the same syllable (examples in (1e)). In particular, /r<sup>s</sup>/ may not exist with non-inflectional front vowels /i, i:, ee/ in the same syllable in which case it loses its emphatic feature and becomes a plain /r/; i.e., it is de-emphasized (Woidich 1980:210).<sup>12</sup> This situation usually leads to emphatic/plain alternations between morphologically related words (Broselow 1976:47). In other words, the emphatic feature on underlying //r<sup>s</sup>// is lost after derivational and morphological modifications where it comes in direct tautosyllabic contact with /i, i:, ee/.<sup>13</sup> Surface /r/ may appear in the onset or coda of the syllable, as shown in (13a–b).

- (13) De-emphasis of onset and coda /r<sup>s</sup>/ next to //i//-realizations
- |    |                  |                  |                                       |                  |
|----|------------------|------------------|---------------------------------------|------------------|
| a. | <i>rigga:l-a</i> | ‘men’            | <i>r<sup>s</sup>ā:qil</i>             | ‘man’            |
|    | <i>rija:s-a</i>  | ‘presidency’     | <i>r<sup>s</sup>ājjis-ŋa</i>          | ‘our president’  |
|    | <i>daris</i>     | ‘educated’       | <i>dir<sup>s</sup>a:s-a</i>           | ‘studying’       |
|    | <i>riħl-a</i>    | ‘journey’        | <i>r<sup>s</sup>āħal</i>              | ‘he departed’    |
|    | <i>ʔar-i</i>     | ‘reading MS’     | <i>ʔar<sup>s</sup>a</i>               | ‘he read’        |
|    | <i>ʔidar-i</i>   | ‘administrative’ | <i>ʔidar<sup>s</sup>-a</i>            | ‘administration’ |
|    | <i>muri:d</i>    | ‘Sufi novice’    | <i>m<sup>s</sup>ur<sup>s</sup>a:d</i> | ‘wish’           |
|    | <i>ħarim</i>     | ‘women’          | <i>ħar<sup>s</sup>aŋ</i>              | ‘wife’           |

<sup>12</sup> Some Standard Arabic loans that are only partially adapted to the dialect seem to resist de-emphasis. One example is *ħāqir<sup>s</sup>* ‘despicable’. Another is *qamār<sup>s</sup>-i* ‘lunar’—as in *sana qamār<sup>s</sup>ijja* ‘lunar year’—where emphatic /r<sup>s</sup>/ is preserved before the *nisba* suffix *-i* (Woidich 2006a:25).

<sup>13</sup> The palatal glide /j/ is theoretically a trigger as well, but there are no words in which /j/ is syllable-adjacent to an alternating plain /r/ (one that alternates with emphatic /r<sup>s</sup>/). One could find instances of /r<sup>s</sup>/ and /j/ in the same syllable separated by a vowel or adjacent in different syllables, but never in a coda cluster. The palatal consonant /j/, however, may share a coda cluster with /r<sup>s</sup>/ but no de-emphasis takes place, e.g., *ʔar<sup>s</sup>* ‘throne’, *ħar<sup>s</sup>* ‘scratching’, *bu<sup>s</sup>ar<sup>s</sup>* ‘palm leaves mat’, *na<sup>s</sup>ʔar<sup>s</sup>* ‘publishing’, and *fa<sup>s</sup>ʔar<sup>s</sup>* ‘bragging’. This will be explained in terms of constraint interactions in §3.2.4.

b.	<i>ta:ɡir</i>	‘merchant’	<i>ṭiɡa:ṛ<sup>s</sup>-a</i>	‘trade’
	<i>mu-xaddir</i>	‘drug’	<i>ṃu-xaddiṛ<sup>s</sup>-a:t</i>	‘drugs’
	<i>ʃim-figir</i>	‘it explodes’	<i>ʃim-figa:ṛ<sup>s</sup></i>	‘explosion’
	<i>taza:kir</i>	‘tickets’	<i>taʒka:ṛ<sup>s</sup>-a</i>	‘ticket’
	<i>kibir</i>	‘old’	<i>kuɓa:ṛ<sup>s</sup></i>	‘old PL’
	<i>kitir</i>	‘many’	<i>ʔa-ktaṛ<sup>s</sup></i>	‘more’
	<i>safir</i>	‘ambassador’	<i>sufaṛ<sup>s</sup>-a</i>	‘ambassadors’
	<i>seer</i>	‘conduct’	<i>ʃa:ṛ<sup>s</sup></i>	‘he proceeded’
	<i>xeer</i>	‘bounty’	<i>xajjaṛ<sup>s</sup></i>	‘he offered a choice to’

Without direct tautosyllabic contact, an emphatic /ṛ<sup>s</sup>/ generally persists, as in (12b) above. There are three counter-facts to this generalization. First, a de-emphasized /ṛ/ remains so across the masculine-feminine paradigm and certain verbal paradigms. This applies even if the triggering environment is no longer present, resulting in non-tautosyllabic /i(:)/ or the loss of /i(:)/ altogether, as in (14a).<sup>14</sup> Second is the tendency for /ṛ<sup>s</sup>/ to undergo de-emphasis when preceded by a non-tautosyllabic long /i:/ with no clear paradigm effects. I postulate that this is a low-level phonetic effect due to the extreme frontness of long /i:/ compared to short /i/ (Birkeland 1952:48). In fact there is some inter-speaker variation between plain /r/ and emphatic /ṛ<sup>s</sup>/ in these cases (14b), but no variation is observed if another emphatic trigger exists in the same word (14d). Last is the broken plural template CiCa:C, where an alternating plain /r/ unexpectedly appears next to non-tautosyllabic /i/ (14c). Given the notorious irregularity of Arabic broken plurals, a possible explanation is that the singular and plural of this pattern are separately stored in the lexicon with one different underlying segment (see Broselow 1976:47).

(14) Apparent exceptions to /ṛ<sup>s</sup>/ de-emphasis

a.	<i>ʔaɗaṛ<sup>s</sup></i>	‘he was able’	<i>ʔa:dir / ʔadr-a</i>	‘able MS/ FS’
	<i>kaɗaṛ<sup>s</sup></i>	‘he got fed up’	<i>ka:fir / kafir-a</i>	‘unbeliever MS/ FS’
	<i>faɗaṛ<sup>s</sup></i>	‘he got immoral’	<i>fa:ɡir / fagr-a</i>	‘libertine MS/ FS’
	<i>xabaṛ<sup>s</sup></i>	‘news item’	<i>xabir / xabir-a</i>	‘expert MS/ FS’
	<i>ʔaxxaṛ<sup>s</sup></i>	‘he delayed’	<i>ʔaxir / ʔaxir-a</i>	‘final MS/ FS’
	<i>faʔiṛ<sup>s</sup></i>	‘poverty’	<i>faʔir / faʔir-a</i>	‘poor MS/ FS’
	<i>ʔin-taʃaṛ<sup>s</sup></i>	‘he spread PAST’	<i>jin-tifir / jin-tifr-u</i>	‘he/ they spread’
	<i>ʔin-ʔaɗaṛ<sup>s</sup></i>	‘he got frustrated’	<i>jin-ʔihir / jin-ʔihr-u</i>	‘he/ they get frustrated’
b.	<i>ɣaṛ<sup>s</sup></i>	‘he was jealous’	<i>ɣiṛ<sup>s</sup>-a ~ ɣir-a</i>	‘jealousy’
	<i>ʃaṛ<sup>s</sup></i>	‘he proceeded’	<i>siṛ<sup>s</sup>-a ~ sir-a</i>	‘topic/biography’
	<i>ħajjaṛ<sup>s</sup></i>	‘he confused’	<i>ħiṛ<sup>s</sup>-a ~ ħir-a</i>	‘perplexity’
	<i>ʔaʃʃaṛ<sup>s</sup></i>	‘he mated with’	<i>ʔafiṛ<sup>s</sup>-a ~ ʔafir-a</i>	‘kindred’

<sup>14</sup> /ṛ<sup>s</sup>/ may optionally remain emphatic in some of these words in what looks like formal usage, where it does not spread further to the left edge, e.g., *xabiṛ<sup>s</sup>-a* and *ʔaxiṛ<sup>s</sup>-a* (14a), but never *faʔiṛ<sup>s</sup>-a*.

c.	<i>fira:n</i>	‘mice’	<i>fa:r<sup>s</sup></i>	‘mouse’
	<i>tira:n</i>	‘bulls’	<i>to:r<sup>s</sup></i>	‘bull’
	<i>gira:n</i>	‘neighbors’	<i>ga:r<sup>s</sup></i>	‘neighbor’
d.	<i>fi<sup>s</sup>ti:r<sup>s</sup>-a</i>	‘phyllo pastry’	<i>xat<sup>s</sup>ti:r<sup>s</sup>-a</i>	‘dangerous FS’
	<i>d<sup>s</sup>ar<sup>s</sup>ti:r<sup>s</sup>-a</i>	‘blind FS’	<i>?as<sup>s</sup>ti:r<sup>s</sup>-a</i>	‘short FS’
	<i>ħaz<sup>s</sup>ti:r<sup>s</sup>-a</i>	‘pen (for animals)’	<i>ħaz<sup>s</sup>ti:r<sup>s</sup>-a</i>	(female name)

De-emphasis of /r<sup>s</sup>/ does not apply if the triggering /i, i:, ee/ vowels are part of an inflectional affix. In other words, morpheme boundaries block de-emphasis (Younes 1993:133). Whether it is a CV prefix that ends in /i/ or a V(C) suffix that begins with /i, i:, ee/, an adjacent /r<sup>s</sup>/ in the same syllable will remain emphatic (15a). The fact that derivational affixes do not behave in the same way has produced some well-known contrasts between words ending in a 1SG possessive suffix *-i* and the identical *nisba* (relational) suffix *-i* (Woidich 1980:210). As shown in (15b), the former retains an onset /r<sup>s</sup>/, while the latter induces /r<sup>s</sup>/ de-emphasis.<sup>15</sup> These semantically related forms are clearly derived from the same underlying stem, as opposed to the semantically distinct contrasts in (15c), which are derived from separate underlying stems with emphatic //r<sup>s</sup>// or plain //r//. Finally, due to paradigm faithfulness, an alternating plain /r/ may appear before certain inflectional suffixes as in *karfir/ kafr-i:n* ‘unbeliever MS/ MPL’ and *?a:dir/ ?adr-i:n* ‘able MS/ MPL’. This is clearly not a case of de-emphasis.

(15) Inflectional /i, i:, ee/ as non-triggers of /r<sup>s</sup>/ de-emphasis

a.	<i>ji-r<sup>s</sup>ħaʕ</i>	‘he kneels’	<i>ji-r<sup>s</sup>ħal</i>	‘he departs’
	<i>ti-r<sup>s</sup>faʕ</i>	‘she lifts’	<i>ti-r<sup>s</sup>muz</i>	‘she symbolizes’
	<i>mar<sup>s</sup>r<sup>s</sup>-i:n</i>	‘passing MPL’	<i>ħafr<sup>s</sup>-i:n</i>	‘digging MPL’
	<i>?amar<sup>s</sup>-e:n</i>	‘two moons’	<i>xabar<sup>s</sup>-e:n</i>	‘two news items’
	<i>?aġbar<sup>s</sup>-it</i>	‘she forced’	<i>ʃaxar<sup>s</sup>-it</i>	‘she snorted’
	<i>ħaġar<sup>s</sup>-ik</i>	‘he deserted you FS’	<i>?aʃʕar<sup>s</sup>-ik</i>	‘he made you FS shiver’
b.	<i>ba?ar<sup>s</sup>-i</i>	‘my cows’	<i>ba?ar-i</i>	‘bovine’
	<i>fa?r<sup>s</sup>-i</i>	‘my poverty’	<i>fa?r-i</i>	‘jinxing’
	<i>bar<sup>s</sup>r<sup>s</sup>-i</i>	‘my land’	<i>barr-i</i>	‘land-related’
	<i>ħaġar<sup>s</sup>-i</i>	‘my stone’	<i>ħagar-i</i>	‘stone-related’
	<i>nar<sup>s</sup>-i</i>	‘my fire’	<i>nar-i</i>	‘fire-related’
	<i>naħr<sup>s</sup>-i</i>	‘my river’	<i>nahr-i</i>	‘river-related’
	<i>ʃahr<sup>s</sup>-i</i>	‘my month’	<i>ʃahr-i</i>	‘monthly’

<sup>15</sup> Herzallah (1990) claims that these two suffixes are homophonous on the surface only, and considers the relational suffix to be underlyingly //ij// (p.131). Her analysis of these alternations in Palestinian Arabic relies on making a distinction between two types of /i/ phonemes: one featurally specified that triggers /r<sup>s</sup>/ de-emphasis and another underspecified (usually epenthetic /i/) that does not. This is not only uneconomical, but it clearly misses the above morphological distinction.

c.	<i>ǧa:r<sup>ǧ</sup>-i</i>	‘my neighbor’	<i>ǧa:r-i</i>	‘running’
	<i>da:r<sup>ǧ</sup>-i</i>	‘my house’	<i>da:r-i</i>	‘aware’
	<i>ʃa:r<sup>ǧ</sup>-i</i>	‘legal’	<i>ʃa:r<sup>ǧ</sup>-i</i>	‘my street’

The discrepancy between inflectional and derivational affixes can be understood in a rule ordering fashion. Watson (2002:276) assumes that /r<sup>ǧ</sup>/ de-emphasis takes place prior to inflectional affixation and once de-emphasis fails to take place at this stage, emphatic /r<sup>ǧ</sup>/ survives on the surface. Now the contrasts in (15b) can be explained as follows. While the derivational affix *-i* is ordered early within level-two morphology (ibid., p.187), the homophonous 1SG possessive suffix is added at a later point where /r<sup>ǧ</sup>/ de-emphasis is no longer operative. A representative derivation of the *baʔar<sup>ǧ</sup>-i* ~ *baʔari* contrast is given in (16)—modified from Younes (1982:67).

(16) The contrast *baʔar<sup>ǧ</sup>-i* ~ *baʔari* in a rule ordering derivation

Underlying form	//baʔar <sup>ǧ</sup> //	//baʔar <sup>ǧ</sup> //	//baʔar <sup>ǧ</sup> //
Derivational affixation	----	<i>baʔar<sup>ǧ</sup>-i</i>	----
/r <sup>ǧ</sup> / de-emphasis	----	<i>baʔar-i</i>	----
Inflectional affixation	----	----	<i>baʔar<sup>ǧ</sup>-i</i>
Emphasis Spread	<i>baʔar<sup>ǧ</sup></i>	----	<i>baʔar<sup>ǧ</sup>-i</i>
Output form	/baʔar <sup>ǧ</sup> /	/baʔari/	/baʔar <sup>ǧ</sup> i/
	‘cows’	‘bovine’	‘my cows’

On a final note, I must note that underlying /t<sup>ǧ</sup>, d<sup>ǧ</sup>, s<sup>ǧ</sup>, z<sup>ǧ</sup>/ do not undergo de-emphasis, e.g., *laʔi:f* ‘nice’ ~ *luʔa:f* ‘nice PL’. It follows that alternations like *ʔida:ri* ~ *ʔida:r<sup>ǧ</sup>a* (13a) involve a trigger /r<sup>ǧ</sup>/ and a surface target /d/ (rather than underlying //d<sup>ǧ</sup>//) that loses its emphatic feature upon /r<sup>ǧ</sup>/ de-emphasis (Younes 1993:128). This may also lead to homophones like *xaḏḏar<sup>ǧ</sup>* ~ *xaḏḏar<sup>ǧ</sup>* ‘he made green ~ he drugged’ but *ta-xḏi:r<sup>ǧ</sup>* ‘greening’ vs. *ta-xḏir* ‘drugging’ (Salib 1981:9, Woidich 2006a:24).

In sum, Cairene has two contrastive phonemes for plain /r/ and emphatic /r<sup>ǧ</sup>. The latter triggers leftward and rightward ES in the word domain. Emphatic /r<sup>ǧ</sup>/ may not surface adjacent to //i//-realizations in the same syllable; i.e., it will lose its emphatic feature and no ES takes place. De-emphasis does not apply, however, if the trigger is part of an inflectional morpheme and within certain paradigms.

### 3.2.3 Features and Representations in CA Emphasis Spread

Emphatics have been described as consonants produced with a primary articulation at the dental/alveolar region and with a secondary articulation that involves constriction of the upper pharynx. Under this view, it is the presence of non-primary articulation that characterizes emphatic phonemes (Davis 1995:472), a fact that motivates the choice of the feature V-place[dor] to represent emphatics in the PSM. It follows that the segment bearing only this feature is the low back vowel /a/, which determines most emphatic contrasts. In fact, Ladefoged (1993:235) asserts that articulatorily the superimposition of this vowel quality is one way to characterize pharyngealization.



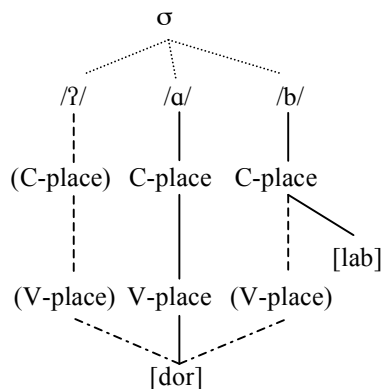
In the previous chapter (§2.2.3.1), I argued for a natural class of C-place[cor] segments that trigger *l*-assimilation. All the emphatic consonants /t̤, d̤, s̤, z̤, r̤/ and their non-emphatic counterparts /t, d, s, z, r/ happen to belong to this class. What distinguishes the emphatic group, then, is an extra V-place[dor] feature. The stops /t̤, d̤/ are also marked for C-manner[closed], while the fricatives /s̤, z̤/ are marked for C-manner[open]. Other consonants have no specification for V-place[dor] underlyingly, but as targets of ES they may acquire it on the surface.

Based on the sonority hierarchy of Selkirk (1984), the highly sonorous liquids /r, r̤/ are specified for both C-manner[open] and C-manner[closed] (see §2.2.3.1). These features correspond to liquids having both a stop gesture and a more open articulation approximating that of a high vowel (thus fairly robust formant structure). Both /r, r̤/ have C-place[cor], and /r̤/ has an additional V-place[dor] feature that is lost upon de-emphasis before or after /i, i:, ee/. I follow Clements and Hume (1995) and Hume (1996) in associating the front vowel /i/ with a V-place[cor] feature. Since the long mid vowel /ee/ is synchronically the result of /i/ and /a/ coalescence (§5.2.3), it must also contain V-place[cor]. Recall from the previous chapter that the palatal consonant /j/ also has a V-place[cor] feature in addition to C-manner[open].

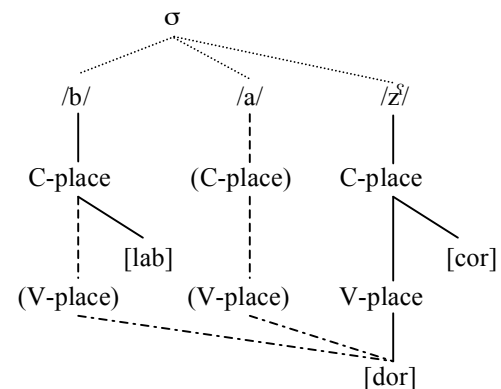
The rest of this section develops the machinery of Cairene ES in autosegmental phonology based on the above assumptions and conclusions. The class of trigger segments includes /t̤, d̤, s̤, z̤, r̤, a/ and is marked with the feature V-place[dor]. Potential targets are all segments within the prosodic word domain. I start with the fact that a syllable containing an emphatic trigger is necessarily realized with emphasis. The trigger segment can be in the nucleus, coda, or onset positions of the syllable (17a–c). The V-place[dor] terminal feature on the trigger spreads obligatorily to the entire syllable, marked by dotted lines. Some target segments may need to project a V-place node to carry the acquired emphatic feature. Targets with existing V-place features do not lead to association line crossing since each feature exists on a separate tier. For ease of exposition, irrelevant manner and laryngeal nodes are left out in the following representations.

(17) ES triggers in different syllable positions

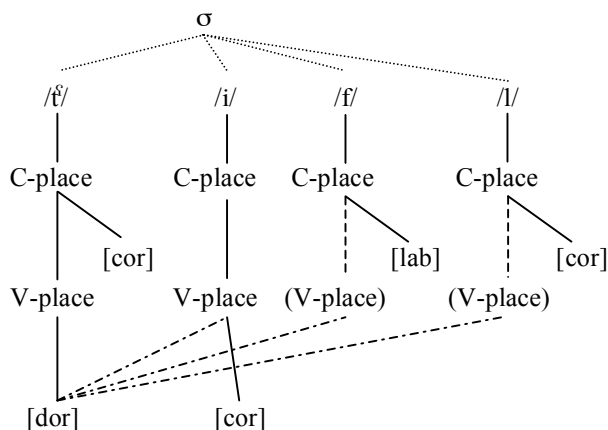
a. //ʔabb// → ʔabb̤



b. //ba:z̤// → ba:z̤̤

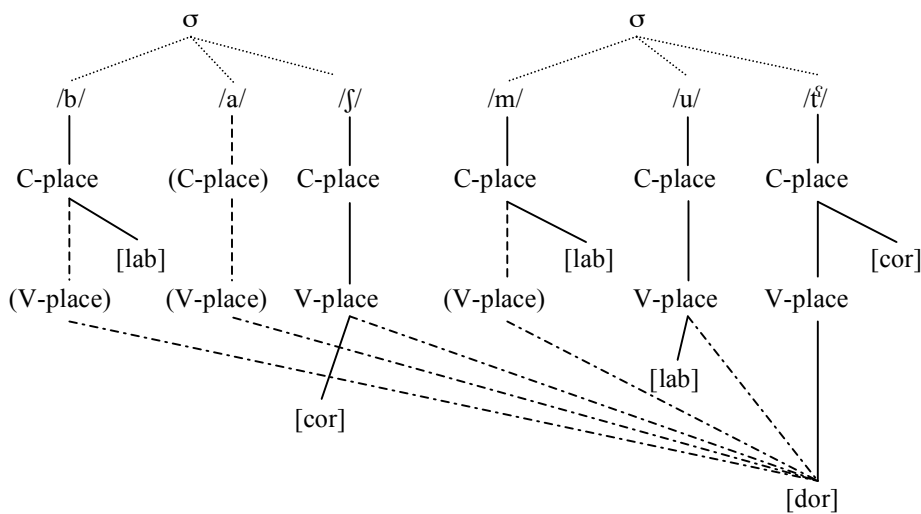


c. //tʰifl// → tʰifl



The next diagram suggests a representation for leftward ES in a word that includes a prefix. Note that the V-place[dor] feature on the emphatic trigger spreads to the beginning of the prosodic word even across the morpheme boundary, and that it combines with other features on the V-place node. This is unlike the assimilation of primary place, which usually involves loss of the original place feature on the target.

(18) Leftward ES: //ba-fmutʰ// → ɓaf.mʊtʰ



As discussed in §3.2.2.1, an underlying back vowel /a/ may trigger ES bidirectionally in the word domain. It is clearly the trigger in the absence of the emphatic coronal consonants /tʰ, dʰ, sʰ, zʰ, rʰ/. In many such words, /a/ seems to occur in every syllable of the stem, which implies multiple potential triggers. However, this may not be the case if the low vowel is part of an affix; it must be a target /a/ that acquires the emphatic feature. Diagram (19) illustrates one such example, where the V-place[dor] feature spreads to the right edge of the suffixed word across V-place[cor]. It shows that ES from a vocalic trigger /a/ is not blocked; and, just like the consonantal triggers, it targets the entire word.

(19) ES from a vocalic trigger: //majjit-ha// → majj<sup>ɛ</sup>it-ha

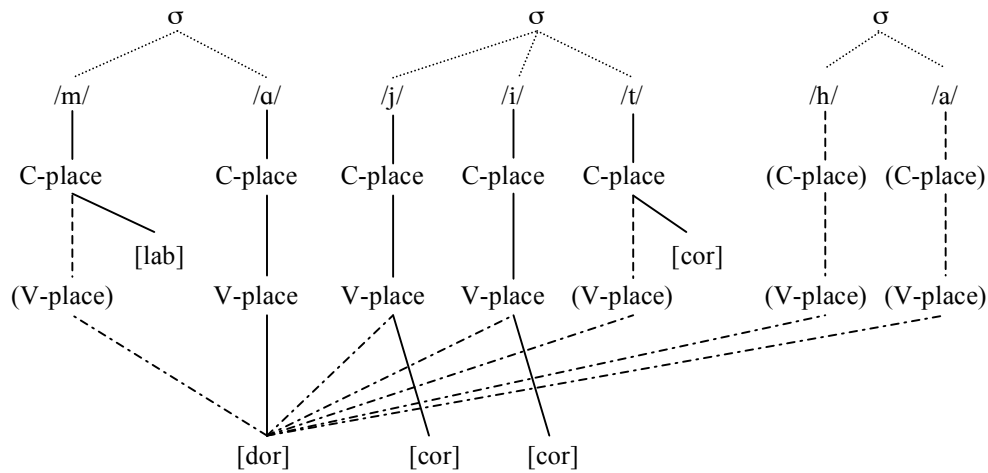
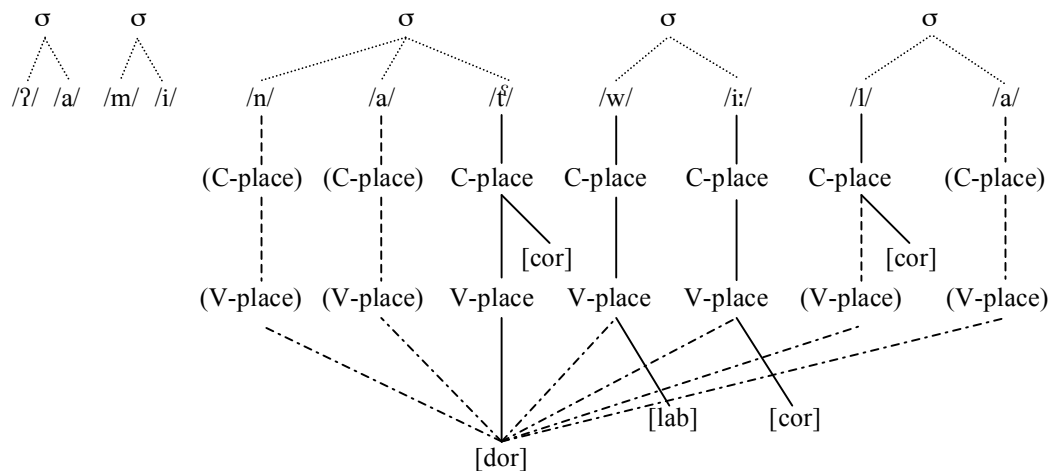


Diagram (20) shows a case in which ES targets segments across the word boundary. The trigger consonant is leftmost, and it will spread the emphatic feature to the right edge of the word. But since it is also syllabified as a coda together with other segments from the preceding word, it will spread emphasis leftwards into the adjacent syllable. Here, one can think of alignment within two separate domains: the prosodic word and the syllable, with predictions for the OT typology.<sup>16</sup>

(20) ES across word boundary: //ʔami:na tʰwi:l-a// → ʔami.ɲa tʰwi:l<sup>ɛ</sup>a

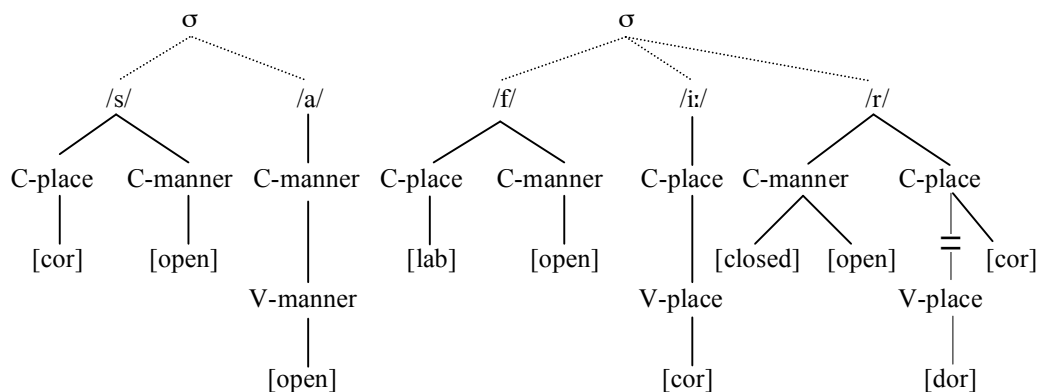


An emphatic /tʰ/ may never be adjacent to //i//-realizations in the same syllable. As a result, the V-place[dor] feature on /tʰ/ is delinked in this environment and no ES takes place, as shown in (21). The ban is formulated as an adjacency restriction on certain

<sup>16</sup> Martin Krämer (p.c.) suggests an alternative analysis by which only one domain is necessary. The basic assumption is that in such cases the prosodic word boundary is shifted to the left/right edge of the syllable in which the initial/final consonant is contained. However, this implies that adjacent prosodic words often have a syllable overlap, with certain complications involved.

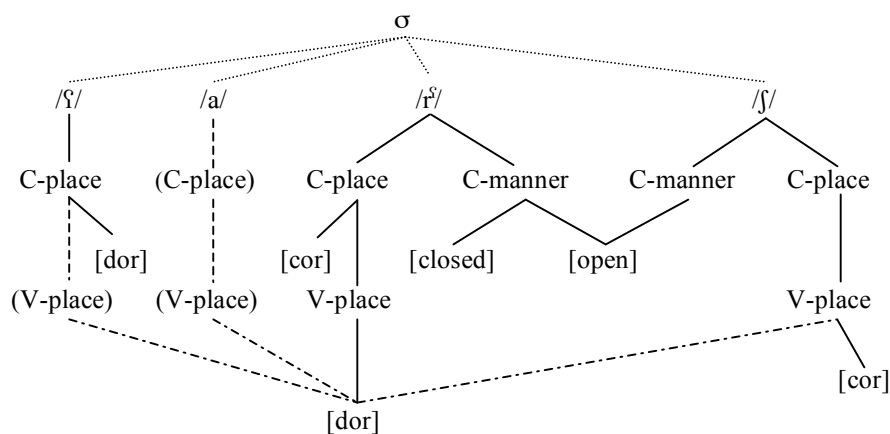
feature combinations within the syllable domain (see §3.2.4), resolved by means of /r<sup>s</sup>/ de-emphasis. An alternative solution is to characterize the de-emphasis of /r<sup>s</sup>/ as an assimilation process whereby the feature V-place[cor] spreads to /r<sup>s</sup>/ with subsequent delinking of V-place[dor] (cf. Herzallah 1990:112). However, this has undesirable ramifications of potentially spreading V-place[cor] to other segments, and it could overlap with the palatalization machinery in CA (§6.2).

(21) De-emphasis of /r<sup>s</sup>/: //safir<sup>s</sup>// → safir



Finally, the representation of the word *ʔar<sup>s</sup>f* ‘throne’ in (22) shows why the adjacency restriction does not apply to /ʃ/ even though it includes a V-place[cor] feature. The reason is that /ʃ/ has another C-manner[open] feature that is shared with the preceding /r<sup>s</sup>/ due to the OCP. As a consequence, no de-emphasis takes place and the emphatic /r<sup>s</sup>/ remains intact.

(22) OCP as a blocker of /r<sup>s</sup>/ de-emphasis: //ʔar<sup>s</sup>f// → ʔar<sup>s</sup>f



Having demonstrated the machinery of ES in a PSM-based version of autosegmental phonology, we are now in a position to attempt a constraint-based explanation of the process.

### 3.2.4 Constraints and Emphasis Spread in CA

To account for the interaction and behavior of consonants and vowels in emphasis spread, I utilize the machinery of constraint interaction in OT, combined with explicit autosegmental representations. Recall that ES in Cairene is a bidirectional process in which V-place[dor] spreads throughout the prosodic word domain. Bidirectionality is translated into two markedness constraints from the alignment family (McCarthy and Prince 1993), formulated in (23a–b). These constraints are gradient in that candidates with various degrees of assimilation result in a different number of violation marks in the specified domain (in terms of distance from the designated edge). Even though a categorical treatment of ES is sufficient in CA, gradience of violation is crucial in BA where blocking takes place, and thus will be used here for typological consistency.<sup>17</sup>

- (23) a. L-ALIGN V-[dor] $\omega$ : The left edge of V-place[dor] must be aligned to the left edge of the prosodic word.
- b. R-ALIGN V-[dor] $\omega$ : The right edge of V-place[dor] must be aligned to the right edge of the prosodic word.

These constraints are in conflict with the faithfulness constraint DEPLINK V-[dor] in (24a) which penalizes new associations of V-place[dor] in the output (see Shahn 2002:43). If gapped configurations are formally admissible, then we must posit an undominated feature-specific NOGAP constraint (24b) against outputs where ES skips over segments (Itô et al. 1995:598). And to prevent de-emphasis of the underlying consonantal emphatics /t̤, d̤, s̤, z̤/, I posit the faithfulness constraint MAXLINK V-[dor] in (24c) which incurs violations for every segment that has an underlying link to V-place[dor] but does not surface with such a link (see Perkins 2005, Morén 2006). Note that every violation of MAX V-[dor] entails violation of MAXLINK V-[dor], but not vice versa. The former constraint is satisfied by outputs that re-associate the emphatic feature (not considered here), and it will not be used in this analysis.

- (24) a. DEPLINK V-[dor]: Do not associate V-place[dor] to a segment that did not have it underlyingly.
- b. NOGAP V-[dor]: The string of segments with a multiply linked V-place[dor] feature must not be interrupted.
- c. MAXLINK V-[dor]: Every V-place[dor] in the input has a correspondent V-place[dor] in the output.

<sup>17</sup> I am aware of McCarthy's (2003) objections and alternative analysis of gradient alignment. Here gradience is used to simplify the analysis instead of having to account for the data with an extended set of unnecessary constraints. Alignment remains a valid solution to a wide range of phonological phenomena including feature spreading (see e.g., Frisch, Pierrehumbert, and Broe 2004).

Tableau (25) shows an instance of an emphatic trigger at the left edge of the prosodic word. The optimal candidate (d) must respect R-ALIGN V-[dor] $\omega$  because ES targets the entire word domain including the suffix, but it also incurs the most violations of the lower ranked DEPLINK V-[dor]. Candidates (a) and (b) exhibit no or incomplete spreading, and they are eliminated by means of R-ALIGN V-[dor] $\omega$ . In (25c), spreading V-place[dor] skips over some segments, violating the undominated constraint NOGAP. Candidate (e) circumvents alignment violations by deleting the underlying emphatic feature on the surface, but it falls victim to MAXLINK V-[dor]. Note that L-ALIGN V-[dor] $\omega$  is irrelevant here since the V-place[dor] feature is already aligned to the left edge.

(25) NOGAP V-[dor], MAXLINK V-[dor], L/R-ALIGN V-[dor] $\omega$  >> DEPLINK V-[dor]

	//t̤abax-na//	NOGAP V-[dor]	MAXLINK V-[dor]	R-ALIGN V-[dor] $\omega$	DEPLINK V-[dor]
a.	t̤abaxna			*!*****	
b.	t̤abaxna			*!*	****
c.	t̤abaxna	*!*			***
d.	t̤abaxna				*****
e.	tabaxna		*!		

Because ES in Cairene is unblocked in either direction, the alignment constraints are ranked higher than several co-occurrence constraints against the combination of V-place[dor] with every other active feature in the language (cf. Thompson 2006). For space limitations, I will only include one such constraint that poses a restriction on the combination of V-place[dor] and V-place[cor], as formulated in (26). This constraint is also useful for typological reasons, as will become clear later.

(26) \*V-[cor, dor]: No segment should simultaneously have the features V-place[cor] and V-place[dor].

By way of summary, the ranking of the above six constraints can be conveniently laid out in Tableau (27). This is an instance of combined leftward and rightward ES in the word domain across a V-place[cor] segment. Any potential output that fails to comply with ALIGNMENT (to the left or to the right), NOGAP, or MAXLINK V-[dor] is rejected. The optimal output (27e) violates \*V-[cor, dor] in addition to multiple violations of DEPLINK V-[dor], which implies that they are ranked lower than the other constraints.

- (27) NOGAP V-[dor], MAXLINK V-[dor], L-ALIGN V-[dor] $\omega$ , R-ALIGN V-[dor] $\omega$  >> DEPLINK V-[dor], \*V-[cor, dor]

	//maḥfaz <sup>̣</sup> -it-ha//	NOGAP V-[dor]	MAXLINK V-[dor]	L-ALIGN V-[dor] $\omega$	R-ALIGN V-[dor] $\omega$	DEPLINK V-[dor]	*V-[cor, dor]
a.	<i>maḥfaz<sup>̣</sup>iṯa</i>			*!*****	*!***		
b.	<i>maḥfaz<sup>̣</sup>iṯa</i>				*!***	*****	
c.	<i>maḥfaz<sup>̣</sup>iṯa</i>			*!*****		****	*
d.	<i>maḥfaz<sup>̣</sup>iṯa</i>	*!*				*****	*
e.	<i>maḥfaz<sup>̣</sup>iṯa</i>					***** ****	*
f.	<i>maḥfazitha</i>		*!				

Recall that ES may target segments beyond the word boundary. This happens when the trigger is syllabified together with other segments from the preceding or following word. In the previous section, I suggested that in such cases ES applies within two separate domains: the prosodic word and the syllable. In a constraint-based grammar, the latter syllable-association requirement is interpreted in terms of two additional constraints that align V-place[dor] to the edges of the syllable, formulated in (28a–b). These gradient constraints may be in conflict with a positional faithfulness constraint against spreading V-place[dor] across a word boundary (28c).

- (28) a. L-ALIGN V-[dor] $\sigma$ : The left edge of V-place[dor] must be aligned to the left edge of the syllable.  
 b. R-ALIGN V-[dor] $\sigma$ : The right edge of V-place[dor] must be aligned to the right edge of the syllable.  
 c. DEPLINK V-[dor] $\omega$ !: Do not associate V-place[dor] to a segment that did not have it underlyingly across the word boundary.

Tableau (29) illustrates a case where the emphatic feature spreads to a syllable of the preceding word. In order to satisfy the high-ranking L-ALIGN V-[dor] $\sigma$ , the emphatic trigger /ṭ/ spreads V-place[dor] within the syllable domain resulting in the emphasis of two segments of the preceding word. This suggests that L-ALIGN V-[dor] $\sigma$  (and by analogy R-ALIGN V-[dor] $\sigma$ ) outranks DEPLINK V-[dor] $\omega$ !. Candidates (b) and (e) are eliminated based on this ranking, while (c) is eliminated by means of NOGAP V-[dor]. On the other hand, the fact that the winning candidate (29d) does not allow ES beyond the adjacent syllable of the preceding word indicates further violations of L-ALIGN V-[dor] $\omega$ , now that the prosodic word boundary has extended to the first syllable of that word. Thus to eliminate candidate (a), which displays ES over the entire phrase, we have to rank DEPLINK V-[dor] $\omega$ ! above L-ALIGN V-[dor] $\omega$ , and it

remains up to the multiple violations of DEPLINK V-[dor] $\omega^1$  to optimally select (29d) in favor of (29a).<sup>18</sup> Finally, candidate (f) is an interesting attempt to bypass all these violations by losing its underlying emphatic feature. It follows that MAXLINK V-[dor] must be ranked above DEPLINK V-[dor] $\omega^1$  and by transitivity above L/R-ALIGN V-[dor] $\omega$  as well.

(29) L/R-ALIGN V-[dor] $\sigma$ , NOGAP V-[dor], MAXLINK V-[dor] >> DEPLINK V-[dor] $\omega^1$   
>> L/R-ALIGN V-[dor] $\omega$  >> DEPLINK V-[dor], \*V-[cor, dor]

	//ʔamina tʷi:la//	L-ALIGN V-[dor] $\sigma$	R-ALIGN V-[dor] $\sigma$	NOGAP V-[dor]	MAXLINK V-[dor]	DEPLINK V-[dor] $\omega^1$	L-ALIGN V-[dor] $\omega$	R-ALIGN V-[dor] $\omega$	DEPLINK V-[dor]	*V-[cor, dor]
a.	ʔamiṇa tʷi:la					***! ***			***** *****	**
b.	ʔamina tʷi:la	*!*							*****	*
c.	ʔamiṇa tʷi:la			*!		**	*****		*****	
d.	ʔamiṇa tʷi:la					**	*****		*** ***	*
e.	ʔamina tʷi:la	*!*						*****		
f.	ʔamina t.wi:la				*!					

The unique behavior of emphatic /r<sup>s</sup>/ is more of a challenge to an OT analysis. Recall that /r<sup>s</sup>/ is de-emphasized where it comes in direct tautosyllabic contact with a non-inflectional /i, i:, ee/ segment. To explain this, we need to posit the adjacency restriction constraint formulated in (30). This is actually shorthand for a conjunction of three co-occurrence constraints on adjacent features within the syllable domain: \*V-[cor]<sub>STEM</sub> V-[dor], \*V-[cor]<sub>STEM</sub> C-[closed] and \*V-[cor]<sub>STEM</sub> C-[open]. The subscript label “<sub>STEM</sub>” limits the triggers of de-emphasis to stem or derivational segments to the exclusion of inflectional ones. And the ban on combining this feature with V-place [dor], C-manner[closed], and C-manner[open] restricts the target of de-emphasis to /r<sup>s</sup>/. The curly brackets in the notation indicate that the order of features is reversible in the syllable domain, and L stands for “liquid”. (30) is in conflict with the faithfulness constraint MAXLINK V-[dor] in (24c).

<sup>18</sup> The constraint DEPLINK V-[dor] $\omega^1$  is only relevant to ES beyond the word domain. And while L/R-ALIGN V-[dor] $\sigma$  apply both within or beyond the word level, they are inviolable and their function overlaps with that of other constraints aligning V-place[dor] with the larger prosodic word domain. Thus for simplicity, these three constraints are not to be included in the remaining tableaux. Finally, the inviolable constraint NOGAP V-[dor] will also be excluded except in the case of multiple triggers.



- (30) \*{V-[cor]<sub>STEM</sub> L-[dor]}σ (shorthand): V-place[cor] on a stem segment cannot co-occur adjacent to V-place[dor], C-manner[closed], and C-manner[open] in the syllable domain.

The interaction of these two constraints accounts for the de-emphasis of underlying /r<sup>s</sup>/ before a tautosyllabic relational suffix -i in *faʔr-i* ‘bringing back luck’. In Tableau (31), the optimal output (31c) violates MAX V-[dor] due to the loss of underlying V-place[dor], ergo \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor]. Suboptimal candidates (31a) and (31b) are ruled out, and whether or not ES takes place is irrelevant.

- (31) \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor] >> L/R-ALIGN V-[dor]ω >> DEP LINK V-[dor], \*V-[cor, dor]

	//faʔr <sup>s</sup> -i//	*{V-[cor] <sub>STEM</sub> L-[dor]}σ	MAXLINK V-[dor]	R-ALIGN V-[dor]ω	L-ALIGN V-[dor]ω	DEP LINK V-[dor]	*V-[cor, dor]
a.	<i>faʔr<sup>s</sup>i</i>	*!		*	***		
b.	<i>faʔr<sup>s</sup>i</i>	*!				****	*
☞ c.	<i>faʔri</i>		*				

Now let us examine a case where /r<sup>s</sup>/ de-emphasis does not apply because the trigger is part of an inflectional morpheme. In the morphologically related word *faʔr<sup>s</sup>-i* ‘my poverty’, the V-place[cor] feature is attached to the 1SG possessive inflectional suffix -i. For this very reason, violations of \*{V-[cor]<sub>STEM</sub> L-[dor]}σ are irrelevant, and it is up to ALIGNMENT and MAXLINK V-[dor] to rule out candidates (32a) and (32c). The optimal candidate (32b) keeps the underlying V-place[dor] feature, which spreads to all segments in the prosodic word domain.

- (32) \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor] >> L/R-ALIGN V-[dor]ω >> DEP LINK V-[dor], \*V-[cor, dor]

	//faʔr <sup>s</sup> -i//	*{V-[cor] <sub>STEM</sub> L-[dor]}σ	MAXLINK V-[dor]	R-ALIGN V-[dor]ω	L-ALIGN V-[dor]ω	DEP LINK V-[dor]	*V-[cor, dor]
a.	<i>faʔr<sup>s</sup>i</i>			*!	*!*		
☞ b.	<i>faʔr<sup>s</sup>i</i>					****	*
c.	<i>faʔri</i>		*!				

Despite the claim that palatal /j/ has a V-place[cor] feature, it is not a trigger of /r<sup>s</sup>/ de-emphasis. The two segments may be adjacent and tautosyllabic in a few coda clusters (fn.13). You may recall, however, that \*{V-[cor]<sub>STEM</sub> L-[dor]}σ comprises three co-

### 3. EMPHASIS SPREAD

occurrence conditions, one of which is  $*V\text{-[cor]}_{\text{STEM}} C\text{-[open]}$ . Unlike /i/ and /ee/, /ʃ/ includes a C-manner[open] feature, in addition to V-place[cor]. The high ranking of OCP C-[open] will force it to share this feature with the adjacent /r/ (see (22)), and  $*V\text{-[cor]}_{\text{STEM}} C\text{-[open]}$  is not violated. The constraint  $*\{V\text{-[cor]}_{\text{STEM}} L\text{-[dor]}\}\sigma$  is then irrelevant, and MAXLINK V-[dor] will eliminate output (33d) in which /r/ undergoes de-emphasis.

- (33) OCP C-[open] ,  $*\{V\text{-[cor]}_{\text{STEM}} L\text{-[dor]}\}\sigma \gg$  MAXLINK V-[dor]  $\gg$  L/R-ALIGN V-[dor] $\omega \gg$  DEPLINK V-[dor],  $*V\text{-[cor, dor]}$

	//ʃarʃ//	OCP C-[open]	$*\{V\text{-[cor]}_{\text{STEM}} L\text{-[dor]}\}\sigma$	MAXLINK V-[dor]	L-ALIGN V-[dor] $\omega$	R-ALIGN V-[dor] $\omega$	DEPLINK V-[dor]	$*V\text{-[cor, dor]}$
a.					*!	*!		
b.							***	*
c.		*!	*!				***	*
d.				*!				

Finally, /r/ de-emphasis may be influenced by paradigm uniformity effects that limit alternation among surface allomorphs (McCarthy 2005a). For example, a masculine form that undergoes de-emphasis will enforce a non-emphatic /r/ on the corresponding feminine, even if the triggering environment is no longer present. To resolve this apparent overapplication of de-emphasis, I propose an Optimal Paradigms (OP) constraint in (34) that prevents a V-place[dor] feature to reappear in the feminine form. One must propose a separate OP constraint for each paradigm correspondence, so OP DEP V-[dor]<sub>M/F</sub> can just be considered an example.

- (34) OP-Dep V-[dor]<sub>M/F</sub>: V-place[dor] in the feminine form of the paradigm must have a correspondent in the morphologically unmarked masculine.

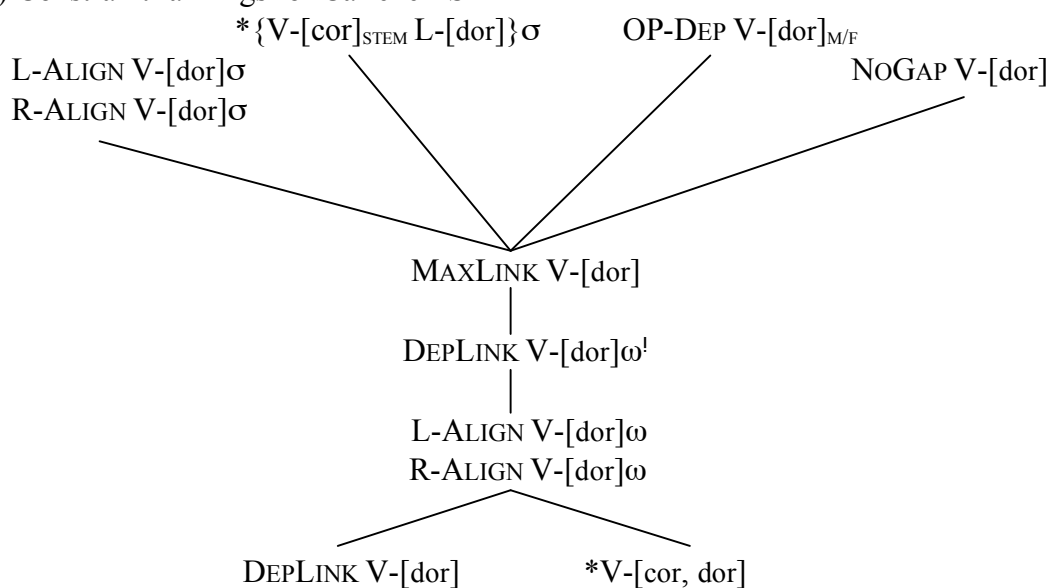
As shown in Tableau (35), respecting OP-DEP V-[dor]<sub>M/F</sub> means that the pair in each paradigm has to agree with regard to V-place[dor] on /r<sup>ɕ</sup>/. Outputs (35c–e), which violate this constraint, are immediately rejected. Other potential outputs that retain an emphatic /r<sup>ɕ</sup>/ in the paradigm fail on \*{V-[cor]<sub>STEM</sub> L-[dor]}σ. The optimal (35f) has double violations of MAXLINK V-[dor], but it fares well with all the other constraints.

(35) OP-DEP V-[dor]<sub>M/F</sub>, \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor] >> L/R-ALIGN V-[dor]<sub>ω</sub> >> DEPLINK V-[dor], \*V-[cor, dor]

	//ka:fir <sup>ɕ</sup> , kafir <sup>ɕ</sup> -a//	OP-DEP V-[dor] <sub>M/F</sub>	*{V-[cor] <sub>STEM</sub> L-[dor]}σ	MAXLINK V-[dor]	L-ALIGN V-[dor] <sub>ω</sub>	R-ALIGN V-[dor] <sub>ω</sub>	DEPLINK V-[dor]	*V-[cor, dor]
a.	<ka:fir <sup>ɕ</sup> , kafir <sup>ɕ</sup> -a>		*!		*** ****	*		
b.	<ka:fir <sup>ɕ</sup> , kafir <sup>ɕ</sup> -a>		*!				**** ****	*
c.	<ka:fir <sup>ɕ</sup> , kafir-a>	*!	*!	*			****	*
d.	<ka:fir, kafir <sup>ɕ</sup> -a>	*!		*	***	*		
e.	<ka:fir, kafir <sup>ɕ</sup> -a>	*!		*			****	
f.	<ka:fir, kafir-a>			**				

The heart of the analysis lies in treating ES as harmony of a vocalic place feature. Triggers of ES are specified as V-place[dor], which must be aligned to the syllable and the word domains simultaneously. Constraints enforcing alignment interact with various other markedness constraints against de-emphasis and faithfulness constraints against feature spreading. The full ranking for ES in Cairene is summarized below.

(36) Constraint rankings for Cairene ES



### 3.3 Emphasis Spread in Baghdadi Arabic

This section examines the process of emphasis spread in Baghdadi Arabic. Despite some obvious similarities to Cairene Arabic, a number of details regarding the class of emphatic triggers, the existence of opaque segments, and the domain of ES are not the same. Using contrasts and alternations, I propose economical and exhaustive feature specifications of the participating segments that explain these differences and provide a uniform account of their unique interactions in BA.

ES in BA has been the topic of several phonetic studies, but only Bellem (2007) has attempted to analyze the phenomenon from a phonological perspective. Upon the difficulty to locate a reasonable number of native BA informants, I have generated data from secondary sources such as Woodhead and Beene's (1967) dictionary of Iraqi Arabic in addition to descriptive grammars and language courses, particularly those of Erwin (1963, 1969), Blanc (1964), McCarthy and Raffouli (1964), Shamdin Agha (1969), and Altoma (1969). The tokens analyzed acoustically were extracted from the CDs accompanying Alkalesi (2001), which comprise roughly 6.5 hours of recording by one speaker (the author). The data extractions were verified for accuracy by a 27 year-old female speaker of BA.

The analysis defines the class of BA emphatic triggers /t̤, s̤, ð̤, f̤, ʔ/ as the natural class of V-place[dor] segments. Importantly, the contrastive data justify the phonemic status of the lateral emphatic /l̤/ and the back low vowel /ɑ/. Crucial to the behavior of ES in BA is the interaction of V-place[cor] with the emphatic feature. I show that different realizations of the high vowel //i// and the palatal consonants /j, ʧ, ʤ/—all characterized by V-place[cor]—are opaque to the rightward spread of emphasis in the stem word domain.

The discussion is organized as follows. Section 3.3.1 summarizes the acoustic and articulatory characteristics of emphatic triggers and their coarticulatory effect on potential targets and blockers within specific domains. Section 3.3.2 presents data and descriptions of ES and constructs the natural classes of participating segments and the domain in which the process applies in BA. Section 3.3.3 provides autosegmental representations of ES and justifies feature specifications for relevant segments based on the PSM. And finally section 3.3.4 proposes a formulation of the assimilation pattern within Optimality Theory.

#### 3.3.1 The Phonetics of Emphasis Spread in BA

This section points out the phonetic correlates of emphasis in BA. The main issues are the articulatory nature of emphatic consonants,<sup>19</sup> the acoustic effect of emphatics on other segments, the domain of ES, and the contexts in which it is blocked.

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<sup>19</sup> In the following section, I argue that the back low vowel /ɑ/ is also a contrastive trigger of ES. But since it is phonetically identical to target low vowels, I will restrict the discussion here to consonantal triggers.

### 3.3.1.1 The Triggers of Emphasis Spread

The precise nature of the emphatic consonants /t̤, s̤, ð̤, l̤/ in BA has been a matter of debate. While Hassan and Esling (2007) provide evidence for a pharyngeal element, Ali and Daniloff (1972) stress the role of tongue root retraction as the differential element of emphatic vs. non-emphatic articulation. As previously noted, both aspects are in fact important in the description of emphatic articulation.

Another aspect that has been investigated is the glottal states of emphatic consonants in BA. Heselwood (1996) and Bellem (2007) conducted acoustic analyses of certain BA plain and emphatic consonants, and measured their Voice Onset Time (VOT) values in pre-vocalic position. Both studies have found that BA /t/ is voiceless aspirated and /t̤/ is voiceless unaspirated (with short lag), and the VOT values for /t/ tend to be roughly double that of /t̤/ (see also Giannini and Pettorino 1982:22). In Bellem's study, the means of these VOT values were 31 ms for /t/ vs. 11 ms for /t̤/ and the two ranges are discrete (2007:77). Heselwood contrasts the BA results with CA in which /t/ and /t̤/ are both voiceless and aspirated with extremely close VOT values (1996:35), which means that there is no difference in laryngeal status between these consonants in CA. This additional voicing distinction for the emphatic series in "bedouin" dialects like BA is clearly a phonetic effect, but it raises questions about whether redundant laryngeal features should be included at all in characterizing, say, emphatic /ð̤/ which has no voiceless cognate. Moreover, it carries implications for the phonetic content of a contrastive laryngeal feature in different consonants, and points out the inherent problems found in full-specification models with a rigid relationship between phonological features and articulatory/acoustic components.

### 3.3.1.2 The Targets of Emphasis Spread

Various studies confirm that emphatic consonants in BA spread pharyngealization, or induce a backing coarticulatory gesture of the tongue in surrounding vowels and consonants. Ali and Daniloff (1972:88) maintain that the consonants are the prime targets of spread, and that the vowels are thus affected by the consonants. Evidence for this comes from cinefluorographic tracings showing that vowels adjacent to the emphatics display backward movement of the tongue towards the rear wall of the pharynx, but only about half as much as that of the emphatics.

Acoustically, vowels surrounded by emphatics have higher F<sub>1</sub> and lower F<sub>2</sub> than those surrounded by non-emphatics (al-Ani 1970). While F<sub>2</sub> lowering is the most consistent acoustic exponent of emphatics reported in different Arabic varieties, it has also been found that in BA F<sub>1</sub> and F<sub>2</sub> are closer to each other for all vowels of words containing one emphatic consonant in any position and of any length (Hassan and Esling 2007:1755). In terms of articulation, this suggests lowering and retraction of the vowel articulation in the environment of an emphatic consonant (Giannini and Pettorino 1982:23). In Figure 2, targets in an emphatic environment are juxtaposed with those in a non-emphatic environment in the minimal pair *ḍaxal̤* ~ *daxal*. I chose this particular pair to show regressive assimilation from the infrequent trigger /l̤/. The syllable nuclei are only composed of /a/ quality for the sake of an easier comparison.

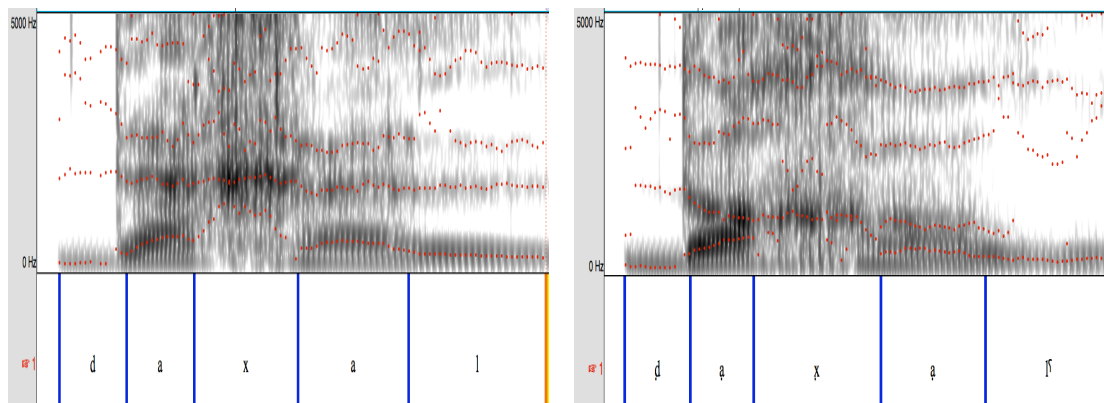


Figure 2. Spectrograms of the words /daxal/ ‘he entered’ and /daxalʕ/ ‘income’ demonstrating a regressive effect of pharyngealization associated with /ʕ/ (extracted from Alkalesi (2001))

Approximation of  $F_1$  and  $F_2$  and, more specifically, lowered  $F_2$  frequencies of the vowels are clearly visible in the rightmost spectrogram. Acoustic measurements show that the first vowel in *daxalʕ* has an  $F_2$  frequency of 1180 Hz, compared to 1750 Hz of the first vowel in *daxal*. Moreover, the  $F_2$  frequency of the low vowel immediately before /ʕ/ was measured at 970 Hz, compared to 1630 Hz of the corresponding vowel before /l/. Such dramatic drops in vowel  $F_2$  in proximity of emphatic /ʕ/, about 600 Hz lower than in non-emphatic contexts, are the same for vowels in proximity of other coronal emphatics (Giannini and Pettorino 1982:28). No raising of  $F_1$  has been noted because the “front” low vowel is already central in BA (Ghazeli 1977:60–1).

The pharyngeals /ħ, ʕ/ are claimed to have an effect on the formants of adjacent vowels. Butcher and Ahmad (1987:171) report that vowels preceded or followed by pharyngeals in BA have lowered and centralized allophones, the main component of which is raising the steady-state frequency of  $F_1$  (and possible lowering of  $F_2$ ). The effect of these consonants is in fact more intense on the formants of adjacent vowels than that of the emphatics. However, the coarticulatory impact never extends beyond adjacent vowels, meaning that it is merely phonetic.

The consonants /r, q, x, ɣ/ are also claimed to have “back” contexts in BA. The coronal /r/ is realized as a pharyngealized flap or trill (unless adjacent to /i/) with an inherently low  $F_2$  (al-Ani 1970), and it results in backing adjacent vowels. Again, this impact is rarely found in distant vowels, which points toward phonetic conditioning (cf. Card 1983:137). Unlike CA, it seems that the classification of /r/ as an emphatic consonant is not justified in BA. The same may be said about uvular /q/ and to some extent about velar /x, ɣ/ which are realized as uvular in some contexts (Rahim 1980: 241–2, Giannini and Pettorino 1982:24). Due to their posterior articulation, these consonants may cause backing of adjacent vowels. Nevertheless, the effect is not always acoustically salient and is prone to variation, which leads one to anticipate low-level coarticulation. The implication is that all of these consonants have a primary [dorsal] articulation as opposed to emphatics which only employ the feature secondarily.

On a last note, Hassan and Esling (2007) observe that certain segments (e.g., /i, ʃ/) may block or weaken the emphatic feature when they are one or more syllables to the

right of the emphatic trigger, consistent with findings in a number of other Arabic dialects. Acoustically, blocking segments /i, ʃ, tʃ, ɟʒ/ are characterized by a high F<sub>2</sub>; thus it is plausible that they block ES, which involves the lowering of F<sub>2</sub> (Hoberman 1989:90). Their second formant is not lowered nor is the second formant of following segments in the same word. This can be motivated by the articulatory incompatibility of [dorsal] and [coronal] secondary place features (Archangeli and Pulleyblank 1994). Note, however, that no blocking is perceived when such segments are tautosyllabic to the emphatic trigger as in *qasʕir* where the spread of the backing gesture to V<sub>2</sub> is very obvious (Ali and Daniloff 1972:99). Additionally, no blocking takes place in the R-L direction of spread. This suggests that anticipatory ES is more prominent than progressive ES in Baghdadi.

### 3.3.1.3 The Domain of Emphasis Spread

There seems to be no agreement on the locus of emphasis in BA. On one hand, Ali and Daniloff (1972) recognize the spread of emphasis “from emphatic consonants to surrounding vowels and even syllables, but never over a whole word”. On the other hand, Erwin (1963:36) claims that the influence of an emphatic consonant *may* extend throughout a syllable or further to the phonological word domain. Finally, the more recent study of Hassan and Esling (2007) confirms the articulatory and acoustic effect (mainly lowered F<sub>2</sub>) on all vowels in BA words containing one emphatic consonant in any position, whether monosyllabic, disyllabic, or trisyllabic. So until further detailed phonetic verification is made, I will accept the latter conclusion that the stem word *is* the domain.

One should bear in mind that the backing gesture in Baghdadi spreads in a slowly decreasing fashion. Distance from the emphatic trigger apparently weakens rightward (but not leftward) emphatic coarticulation. In addition, there is clearly more going on than a simple case of blocking by sounds with high second formants /i, ʃ, tʃ, ɟʒ/. The presence of long vowels and certain consonants seems to slightly weaken emphatic coarticulation. These aspects of emphasis—viz., gradience and weakening effects—are the result of low-level functional factors, and they can be ignored with no impact on the phonology. Thus in the discussion to follow, emphasis will be treated as either present or not present, bearing in mind that such a binary yes-no (phonological) treatment is not always phonetically accurate.

In sum, emphatic consonants in BA are characterized by clear retraction of the tongue dorsum and/or constriction of the pharyngeal wall. Neighboring consonants and vowels exhibit a similar backing/pharyngealization gesture throughout the word domain. This coarticulatory effect extends bidirectionally, but it may be blocked or weakened in the left-to-right direction by non-tautosyllabic front vowels and palatal consonants. The inability of these segments to block when they exist in the same syllable as the emphatic trigger implies a persistent coarticulation impact of the backing gesture over the syllable, which led Ali and Daniloff (1972) to hypothesize that emphasis is a syllable-tied process. Given the flaws of the suprasegmental account (see §3.1.2.1), I pursue a modified segmental account of BA emphasis spread below.

## 3.3.2 Triggers, Blockers, and Domain of Emphasis Spread in BA

## 3.3.2.1 Trigger Segments

All consonants in Baghdadi can be realized with emphasis, but there is evidence that only /t̤, s̤, ð̤, f̤/ have a contrastive status. These segments play an influential role in the phonological structure of the language in several respects: (i) they distinguish a large number of minimal pairs; (ii) they occur in any phonological environment (i.e., next to or near any other sound); (iii) roots containing them display emphasis throughout the paradigm (Erwin 1963:15)—with the exception of /f̤/ which undergoes de-emphasis in some well-defined environments. Below I introduce alternations and contrastive data involving each of these emphatic consonants.

The voiceless emphatic stop /t̤/ and fricative /s̤/ are found in all phonological environments as regards word position (initial, medial, or final) and adjacent vowels (low or non-low vowels). A large number of minimal pairs are distinguished by /t/~/t̤/ and /s/~/s̤/ contrasts, as shown in (37a–b). Historically plain /s/ became emphatic /s̤/ next to the velars /x, g/ in a number of words (Altoma 1969:17), and synchronically plain /t/ and /s/ become and remain emphatic to the left of other contrastive coronal emphatics.

(37) Contrasts involving emphatic /t̤, s̤/ vs. non-emphatic /t, s/

a.	<i>t̤i:n</i>	‘mud’	<i>ti:n</i>	‘figs’
	<i>t̤u:b</i>	‘bricks’	<i>tu:b</i>	‘repent! MS’
	<i>t̤oʕob-a</i>	‘ball’	<i>toob-a</i>	‘repentance’
	<i>t̤a:b</i>	‘he recovered’	<i>ta:b</i>	‘he repented’
	<i>t̤amm</i>	‘he buried’	<i>tamm</i>	‘it was completed’
	<i>b̤at̤t̤</i>	‘ducks’	<i>batt</i>	‘he decided’
	<i>ʃ̤at̤t̤-a</i>	‘his river’	<i>ʃatta</i>	‘he put on winter clothes’
b.	<i>s̤i:r</i>	‘become! MS’	<i>sir</i>	‘march! MS’
	<i>s̤eef</i>	‘summer’	<i>seef</i>	‘sword’
	<i>s̤oʕod-a</i>	‘soda’	<i>sood-a</i>	‘black FS’
	<i>s̤add</i>	‘he repelled’	<i>sadd</i>	‘dam’
	<i>s̤iʃ̤ad</i>	‘he went up’	<i>siʃad</i>	‘he became happy’
	<i>na:s̤i</i>	‘low’	<i>nasi</i>	‘having forgotten’
	<i>na:s̤i:b</i>	‘destiny’	<i>nasi:b</i>	‘relative-in-law’
	<i>x̤as̤s̤</i>	‘he specified’	<i>xass</i>	‘lettuce’

While CA has four coronal obstruent emphatics, BA has only three. This is due to the fact that Old Arabic /ð̤/ is no longer preserved in BA, but has fallen together with the interdental spirant /ð̤̤/. This merger has given rise to a prevalent confusion in defining minimal pairs that show a /ð̤̤/~/ð̤̤̤/ contrast in OA (38a) (Altoma 1969:13). Minimal pairs that contrast /ð, d/ with /ð̤̤̤/ are abundant, as exemplified in (38b–c). Plain /ð/



may also be realized with emphasis to the left of contrastive coronal emphatics, and historically next to the velars /x, g/ (ibid., p.14).

(38) Emphatic /ð̤/ ambiguity and contrasts with non-emphatic /ð, d/

a.	<i>ħað̤ar</i>	‘urbanity/ prohibition’	<i>ð̤ufar</i>	‘he plaited/ he overcame’
	<i>ð̤alla</i>	‘he misled/ he shaded’	<i>fa:jið̤</i>	‘overflowing/ usury’
	<i>ð̤ann</i>	‘he thought/ he was avaricious’		
b.	<i>ð̤abb</i>	‘he tightened’	<i>ðabb</i>	‘he threw’
	<i>ð̤a:f</i>	‘he got lost’	<i>ða:f</i>	‘he broadcast’
	<i>ð̤ali:l</i>	‘shady’	<i>ðali:l</i>	‘lowly’
	<i>mað̤all-a</i>	‘umbrella’	<i>maðall-a</i>	‘humiliation’
	<i>ta-nfi:ð̤</i>	‘brushing off’	<i>tanfi:ð</i>	‘carrying out’
c.	<i>ð̤amm</i>	‘he hid’	<i>damm</i>	‘blood’
	<i>fa:ð̤</i>	‘it overflowed’	<i>fa:d</i>	‘he benefited’
	<i>ʕað̤</i>	‘he bit’	<i>ʕadd</i>	‘he counted’
	<i>ħað̤-a</i>	‘her luck’	<i>ħadd-a</i>	‘her limit’
	<i>ħað̤am</i>	‘he digested’	<i>hadam</i>	‘he destroyed’

Emphatic /l̤/ has been noted to occur independently from other coronal emphatics in Arabic dialects in the frequently used word *ʔalʕa:h* (Ferguson 1956). Based on one lexical item, however, Ghazeli rejects the argument for a phonemic /l̤/ in most Arabic dialects, “except perhaps for Iraq where speakers seem to make a distinction between /l/ and /l̤/ phonemes” (1977:145). Baghdadi is remarkable in that it has emphatic /l̤/ in several unpredictable items with minimal pairs contrasting emphatic /l̤/ and plain /l/ (Shamdin Agha 1969:50); some are given in (39b). The independent emphatic /l̤/ may not appear before or after //i/-realizations in the same syllable, meaning that it undergoes de-emphasis (see §3.3.2.3). Instances of /l̤/ are observed in loanwords and in the immediate neighborhood of or in the same syllable as a velar consonant /x, ɣ, g/ or a labial when the latter is preceded by /x, ɣ, g/ (Erwin 1963:16, Altoma 1969:15). These occurrences suggest that pharyngealization of OA /l/ occurred largely in roots where it was preceded by the historical uvulars /χ, ʁ, q/ (Blanc 1964:20), yet the data in (39) suggest that /l/ and /l̤/ are synchronically contrastive in BA.

(39) Emphatic /l̤/ environments and contrasts with non-emphatic /l/

a.	<i>ǧal̤ub</i>	‘heart’	<i>ǧl̤u:b</i>	‘hearts’
	<i>ǧoql̤</i>	‘saying’	<i>ma-ǧl̤u:b</i>	‘turned down’
	<i>ǧabul̤</i>	‘before’	<i>ǧamul̤</i>	‘lice’
	<i>xal̤a:l̤</i>	‘unripe dates’	<i>ǧal̤ǧal̤</i>	‘he juggled’
	<i>xal̤aǧ</i>	‘ragged’	<i>xul̤uǧ</i>	‘patience’
	<i>mxaḅḅal̤</i>	‘crazy’	<i>ɣal̤aǧ</i>	‘latch’
	<i>ɣafl̤-a</i>	‘suddenly’	<i>ɣaful̤</i>	‘inattentively’
	<i>ʃuɣul̤</i>	‘work’	<i>buɣul̤</i>	‘cereal’

	<i>ba:lʕo:n</i>	‘balloon’	<i>do:lʕma</i>	‘stuffed vegetables’
	<i>bo:lʕ-a</i>	‘whore’	<i>ba:ŋga:lʕa</i>	‘bungalow’
b.	<i>ba:lʕa</i>	‘please’	<i>ball-a</i>	‘he wet it’
	<i>wa:lʕa</i>	‘really’	<i>walla</i>	‘he went away’
	<i>ga:lʕa</i>	‘he fried’	<i>gall-a</i>	‘he told him’
	<i>xa:lʕ-i</i>	‘my uncle’	<i>xa:l-i</i>	‘empty’
	<i>xa:lʕ-i</i>	‘my vinegar’	<i>xall-i</i>	‘leave! MS’
	<i>da:lʕ-a</i>	‘wedding’	<i>daxl-a</i>	‘let him enter’
	<i>da:lʕ</i>	‘income’	<i>daxal</i>	‘he entered’
	<i>ga:wwalʕ</i>	‘he made a goal’	<i>gawwal</i>	‘it stagnated’

Excluding words that contain the contrastive emphatics /tʕ, sʕ, ðʕ, fʕ/, all other occurrences of surface emphatic consonants are limited to the neighborhood of a back low vowel /a/. As I have argued in CA, this distribution suggests that /a/ is a contrastive phoneme with an underlying emphatic feature, as opposed to front /a/ (Ghazeli 1977, cf. Younes 1982). Thus traditional claims of secondary emphatics are refuted in this account. In BA, the alleged list comprises /rʕ, zʕ, mʕ, pʕ, bʕ, fʕ/.

The only non-labial elements in this set are emphatic /r/ and /z/. As for /r/, I have shown in §3.3.1.2 that its coarticulatory backing effect is mainly limited to adjacent vowels, and hence not phonological. The distinction between [r] and [rʕ] is allophonic: the former is predominant in *i*-environments and the latter elsewhere. Given the lack of contrastive evidence to distinguish two (emphatic vs. non-emphatic) phonemes in Baghdadi, I argue for only a plain phoneme /r/. Contrary to Bellem (2007:285), I do not assume that /r/ is featurally emphatic even though it does not spread this property. The voiced coronal fricative /z/ may exist as a conjunct secondary emphatic, as in *zuma:lʕ* ‘he boasted’ and *zma:lʕ* ‘donkey’, or as the outcome of /sʕ/ voicing assimilation, as in *?azʕdiqa:ʔ* ‘friends’ and *zʕajjir* ‘little’ (Erwin 1963:17). Otherwise, a surface /zʕ/ is restricted to a few words containing a back low vowel /a/.<sup>20</sup>

The labial surface emphatics /mʕ, pʕ, bʕ, fʕ/ occur primarily in loanwords, and are limited to syllables that contain a back low vowel /a/. In native words, they usually occur when the other, or nearest, consonant in the word is a velar (Erwin 1963:16). The data in (40a–b) show the environments where these surface emphatics occur and a few minimal pairs, all involving /a/~a/ contrasts. These limited environments imply that /mʕ, pʕ, bʕ, fʕ, zʕ/ are not contrastive phonemes in BA.

(40) BA words with non-coronal “secondary emphatics”

a.	<i>ʕuzma</i>	‘boots’	<i>ʕizda:n</i>	‘wallet’
	<i>pa:ŋka</i>	‘fan’	<i>pa:mʕ</i>	‘pump’
	<i>ba:ŋg</i>	‘bugs/gnats’	<i>gu:bʕa</i>	‘room’
	<i>ku:bʕa</i>	(a meat dish)	<i>ma:ma</i>	‘mommy’

<sup>20</sup> Surface /zʕ/ often occurs in syllables with an onset /ʕʕ/, a fact that could be attributed to the Turkish origin of these words (Shamdin Agha 1969:59).

<i>baṃḃa</i>	‘bomb’	<i>ḃa:mja</i>	‘okra’
<i>baṅḡ</i>	‘bank’	<i>wa:ḡuḡ</i>	‘standing MS’
<i>duḡma</i>	‘button’	<i>ḡumma</i>	‘they’
b. <i>ḡazz</i>	‘it creaked’	<i>ḡazz</i>	‘he sheared’
<i>ba:b-a</i>	‘daddy’	<i>ba:b-a</i>	‘his door’
<i>majj</i>	‘water’	<i>majj</i>	(female name)
<i>fakḡ</i>	‘he opened’	<i>fakk</i>	‘jaw’ [commonly <i>fatḡf</i> ]

The assumption that the so-called secondary emphatics are underlyingly plain consonants that become targets of ES triggered by /a/ (where there are no contrastive emphatic consonants available) is independently supported by two facts in BA. The first is the appearance of emphatic consonants in loanwords that contain a back low vowel in the source language (see Ferguson 1956:450). This tendency is even more conspicuous than in CA (41). The second fact is that the “secondary emphatics” occur mostly adjacent to or in the neighborhood of /x, ɣ, g/. Historically, these velars are thought to have developed from the uvulars /χ, ʁ, q/, respectively, which triggered phonetic backing of the adjacent low vowel. Synchronically, the back low vowel remained in the sound system although the factors that caused its backing are no longer present, and so became an independent phoneme /a/ (Ghazeli 1977:143).

(41) Baghdadi Loanwords with emphatic consonants

<i>pōosṡ-a</i>	‘post’	<i>sṡabatṡa:n-a</i>	‘barrel’
<i>tṡama:tṡ-a</i>	‘tomatoes’	<i>zalatṡa:tṡ-a</i>	‘salad’
<i>nootṡ</i>	‘banknote’	<i>ḃasṡ</i>	‘bus’
<i>sṡa:bu:n-a</i>	‘soap’	<i>sṡa:l-a</i>	‘auditorium’
<i>pa:lṡu</i>	‘coat’	<i>pōotṡar</i>	‘powder’
<i>ṡalṡma:z</i>	‘diamond’	<i>ṡalṡma:n</i>	‘Germans’

Instances of multiple potential emphatic triggers are common in Baghdadi. Except for a handful of words, roots with more than one of /t, s, ḡ, ṡ, ḡ/ have either both consonants realized as emphatic or both as non-emphatic. Many of the emphatic words seem to involve reduplication (42a). In others (42b), the written forms imply that the rightmost consonant bears the original contrastive emphatic feature. Although one may refute that the apparently-archaic orthography is relevant to synchronic phonological processes, it is a fact that in Arabic roots an emphatic coronal may precede a non-emphatic coronal, but generally not vice versa (Bellem 2007:274). In line with synchronic evidence, I mark all potential triggers as underlyingly emphatic (except in affixes). And in the case of words that include emphatic /ṡ/ in combination with /ṡ, sṡ, ḡ/, multiple triggers appear only where no de-emphasis takes place. Finally, in the presence of a contrastive emphatic consonant /ṡ, sṡ, ḡ, ṡ/ and a low back vowel, the consonant is generally assumed to be the trigger rather than an underlying emphatic /a/. The reason is that in many such words the low back vowel alternates with other

vowels in the morphological paradigm, as shown in (42c). Only in the absence of /t̤, s̤, ð̤, l̤/ does the back low vowel /a/ count as the trigger of ES as in (40) above.

(42) Multiple potential /t̤, s̤, ð̤, l̤/ triggers of ES

a.	<i>t̤ab̤t̤ab̤</i>	‘he patted’	<i>t̤aḡt̤aḡ</i>	‘it rattled’
	<i>s̤ufs̤a:f̤</i>	‘willow’	<i>s̤urs̤ur̤</i>	‘cockroach’
	<i>ð̤ab̤ð̤ab̤</i>	‘he tied up’	<i>ð̤aḡð̤aḡ</i>	‘he undermined’
b.	<i>ð̤a:buḡt̤</i>	‘officer’	<i>ð̤iḡat̤</i>	‘he farted’
	<i>s̤t̤u:ḡ</i>	‘roof’	<i>s̤at̤il̤</i>	‘bucket’
	<i>s̤uḡu:t̤</i>	‘falling’	<i>t̤aḡis̤</i>	‘weather’
	<i>t̤amus̤</i>	‘sinking down’	<i>s̤ax̤al̤</i>	‘goat’
	<i>x̤il̤at̤</i>	‘he mixed’	<i>t̤il̤aḡ</i>	‘he appeared’
c.	<i>s̤add̤</i>	‘he repelled’	<i>s̤udd̤</i>	‘repel! MS’
	<i>ʃat̤t̤</i>	‘river’	<i>ʃtu:t̤</i>	‘rivers’
	<i>ð̤a:ḡ</i>	‘it got narrow’	<i>ð̤i:ḡ</i>	‘narrowness’

To summarize, I have maintained that /t̤, s̤, ð̤, l̤, a/ are the natural class of emphatic triggers in BA, and that they share a single feature. In addition to the uncontroversial /t̤, s̤, ð̤/, the lateral emphatic /l̤/ is also contrastive because it occurs in non-low vowel environments (with no other potential triggers). The argument for a contrastive /a/ is motivated by the distributional facts of other surface emphatic consonants, which are restricted to the neighborhood of this back low vowel. All in all, this characterization of the underlying emphatic triggers is justified on the sole basis of contrastive phonological behavior.

### 3.3.2.2 The Domain of Emphasis Spread

The data in the foregoing section have shown that emphasis spread triggered by the contrastive segments /t̤, s̤, ð̤, l̤, a/ may extend to other syllables in BA. The process is bidirectional, but there are interesting differences in behavior depending on the direction of spread. Leftward spread is absolute and extends to the beginning of the stem word, whereas rightward spread is interrupted by a subset of vowels and consonants in the same domain. The focus of this section is to describe these blocking and directionality effects and to define the exact domain in which ES applies in BA.

Despite the difficulties posed by the gradient nature of emphatic coarticulation, Hassan and Esling (2007) have acoustically verified spread over the word domain. The examples in (43a–c) show ES in monosyllabic, disyllabic, and trisyllabic stem words of different templates.<sup>21</sup> The process applies both rightwards and leftwards, depending on the position of the underlying trigger.

<sup>21</sup> Note that some of the word templates may differ in BA and CA, due to varying requirements on vowel length and consonant clusters in the onset or coda.

## (43) a. ES in mono-syllables

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
CV(V)C	<i>tʔaxx</i>	‘he bumped’	<i>sʔakk</i>	‘he clenched’
	<i>tʔeef</i>	‘vision’	<i>ðʔa:ʔ</i>	‘he got lost’
	<i>gʔoolʔ</i>	‘saying’	<i>tʔooz</i>	‘dust’
CVCC	<i>ʔʔansʔ</i>	‘chance’	<i>baʔŋg</i>	‘bank’
	<i>ʔʔarðʔ</i>	‘honor’	<i>ʔʔarðʔ</i>	‘land’
CCV(V)C	<i>ðʔba:ʔ</i>	‘hyenas’	<i>ħwə:ðʔ</i>	‘pools’
	<i>sʔfu:f</i>	‘queues’	<i>qʔfa:sʔ</i>	‘cages’
	<i>sʔu:ħ</i>	‘roofs’	<i>bʔa:lʔ</i>	‘mules’

## b. ES in bi-syllables

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
CVCV	<i>tʔufa</i>	‘he floated’	<i>ðʔuwa</i>	‘he gleamed’
	<i>sʔada</i>	‘echo’	<i>sʔufa</i>	‘it became clear’
CVCVC	<i>tʔalʔab</i>	‘demand’	<i>tʔufaħ</i>	‘it became full’
	<i>sʔubaʔ</i>	‘he painted’	<i>ðʔuʔan</i>	‘he guaranteed’
	<i>ðʔaxxam</i>	‘he enlarged’	<i>laʔtʔaf</i>	‘he made pleasant’
	<i>fura:sʔ</i>	‘chances’	<i>luʔaðʔ</i>	‘he enunciated’
CVVCVC	<i>ðʔa:ʔaf</i>	‘he doubled’	<i>tʔa:baq</i>	‘he compared’
	<i>sʔa:ħab</i>	‘he befriended’	<i>sʔa:faħ</i>	‘he shook hands’
CVCVVC	<i>tʔuqu:ʔ</i>	‘cowardly’	<i>ðʔuhur</i>	‘appearance’
	<i>sʔuħu:n</i>	‘plates’	<i>naʔa:tʔ</i>	‘activity’
	<i>gʔasʔsʔa:b</i>	‘butcher’	<i>xatʔa:tʔ</i>	‘calligrapher’
CVCCV(V)C	<i>tʔabʔan</i>	‘of course’	<i>tʔamʔan</i>	‘he calmed’
	<i>tʔuħʔub</i>	‘water moss’	<i>luʔʔan</i>	‘please’
	<i>tʔarbu:f</i>	‘fez’	<i>ʔasʔfu:r</i>	‘sparrow’
	<i>sʔa:ʔu:k</i>	‘pauper’	<i>sʔaħra:ʔ</i>	‘desert’
CVVCVVC	<i>tʔa:bu:g</i>	‘brick’	<i>ma:tʔoor</i>	‘motor’
	<i>sʔa:lʔoon</i>	‘salon’	<i>sʔa:bu:n</i>	‘soap’

## c. ES in tri-syllables

<i>template</i>	<i>word</i>	<i>gloss</i>	<i>word</i>	<i>gloss</i>
CVCVVCVC	<i>raʔwa:bitʔ</i>	‘bonds’	<i>maʔa:ðʔid</i>	‘desks’
	<i>ħaʔwa:sʔil</i>	‘craws’	<i>baʔa:nisʔ</i>	‘bathrobes’
CV(C)CVCVVC	<i>paʔtʔaʔoon</i>	‘pants’	<i>paʔʔama:lʔ</i>	‘sarong-like’
	<i>puʔʔaqa:l</i>	‘oranges’	<i>baʔani:tʔ</i>	‘hats’

The only exception to this assimilation effect is when a non-tautosyllabic realization of the high vowel //i// (that is /j, i, i:/ and possibly /ee/) or a palatal consonant /ʃ, tʃ, ʧ/ exists in the same word (Bellem 2007:231). These non-targets are also blockers; they neither become emphatic nor allow emphasis to spread through them, and the onset of the syllable in which they exist is de-emphasized. Left-to-right ES is blocked by any (or several) of these segments, as shown in (44a–b). This, as well as their unmistakable phonetic similarity, suggests that they share a phonological feature.

## (44) Blocked L-R emphasis spread

a.	<i>sʕajja:d</i>	‘fisherman’	<i>sibjan</i>	‘boys’
	<i>sʕajja:f</i>	‘he summered’	<i>tʕawli</i>	‘backgammon’
	<i>tʕalib</i>	‘student’	<i>ðʕalim</i>	‘unjust’
	<i>sʕana:di:q</i>	‘boxes’	<i>sʕahi:h</i>	‘correct’
	<i>tʕa:jib</i>	‘fuss PL’	<i>ðʕajjig</i>	‘narrow’
	<i>la:tʕajif</i>	‘favors’	<i>ðʕama:jir</i>	‘consciences’
b.	<i>tʕurʃi</i>	‘pickles’	<i>matʕa:bi:ʧ</i>	‘double-tubed flute’
	<i>tʕaba:fir</i>	‘chalk’	<i>tʕarabi:f</i>	‘fezzes’
	<i>tʕabbaf</i>	‘he splashed’	<i>tʕarbu:f</i>	‘fez’
	<i>sʕawwatf</i>	‘he accused’	<i>sʕatʃim</i>	‘shot’

On the other hand, leftward ES is never blocked in the stem word domain even when a front high vowel /i/ or a palatal exists in an adjacent syllable. This directional asymmetry of ES, exemplified in (45a), is attested in various other Arabic dialects (see e.g., Davis 1995 for Southern Palestinian, and Adra 1999 for Syrian Arabic) and even in other languages (see Cook’s (1993) account of Chilcotin flattening). Moreover, both rightward and leftward ES are never blocked if a high vowel /i/ or a palatal exists in the same syllable as the emphatic trigger (45b). This suggests that all segments in the syllable must essentially agree with regard to emphasis. Watson (2002) argues that assimilation processes in general are more likely to take place in a small domain than in a large domain, suggesting that ES will apply from an emphatic trigger to tautosyllabic opaque segments, but will be blocked by non-tautosyllabic ones (p.276).

## (45) Unblocked emphasis spread (with potential blockers)

a.	<i>ħitifa:ðʕ</i>	‘maintenance’	<i>ħajtʕar</i>	‘he beat severely’
	<i>naʃa:tʕ</i>	‘energy’	<i>ʃa:tʕir</i>	‘clever’
	<i>tʃatʕalʕ</i>	‘fork’	<i>tʃaŋqalʕ</i>	‘he hooked together’
	<i>ʧʕamu:sʕ</i>	‘feces’	<i>ʧʕarasʕ</i>	‘bell’
b.	<i>tʕitʕaʃ</i>	‘he appeared’	<i>sʕitʕa</i>	‘he broke into’
	<i>ʔasʕa:tʕir</i>	‘legends’	<i>maʃbi:ðʕ</i>	‘ovary’
	<i>sʕajtʕar</i>	‘he dominated’	<i>ðʕaʧʕ</i>	‘he clamored’
	<i>sʕeʕd</i>	‘hunting’	<i>ðʕeʕf</i>	‘guest’
	<i>ħutʕaf</i>	‘he knocked down’	<i>tʕaʃʃ</i>	‘he scattered’

As a rule, emphasis does not spread into affixes in BA. That is to say, the application of rightward and leftward ES is obstructed by morpheme boundaries. The example sets in (46a–d) show nominal and verbal suffixes and prefixes, all of which include a low vowel /a/ that is not backed by way of ES. Similar to the blocking mechanism, the whole syllable which the affix is part of is not realized with emphasis, meaning that a segment from the adjacent stem will, unless it is underlyingly emphatic, come to be plain when syllabified with the affix (see Benhallam 1980:101 with reference to Moroccan). Recall that no Arabic affixes contain an underlying emphatic consonant.

## (46) Morpheme boundaries as blockers of ES

a.	<i>laʔi:f-a</i>	‘favor’	<i>sʔa:n-a</i>	‘wrench’
	<i>ðarb-at</i>	‘blows’	<i>xuðraw-at</i>	‘vegetables’
	<i>ðanaḵ-na</i>	‘our distress’	<i>tʔbuʔ-na</i>	‘our disposition’
	<i>sʔaff-ak</i>	‘your row’	<i>ðahaḵ-ha</i>	‘her back’
	<i>tʔmaʔ-a</i>	‘his greed’	<i>sʔaḥn-a</i>	‘his plate’
	<i>ðaʔf-a:n</i>	‘having grown thin’	<i>sʔaḥ-a:wi</i>	‘sideways’
b.	<i>ntʔa:-na</i>	‘he gave us’	<i>ða:f-na</i>	‘he added us’
	<i>ʃtiyaʔ-na</i>	‘we worked’	<i>sʔin-at</i>	‘she manufactured’
	<i>ðuḡn-ak</i>	‘he guaranteed you’	<i>tʔa:ʔab-ak</i>	‘he demanded you’
	<i>joosʔuf-a</i>	‘he describes him’	<i>fakk-a</i>	‘he opened it MS’
	<i>gaʔʔa:-ha</i>	‘he fried it FS’	<i>sʔam-ha</i>	‘he fasted it FS’
c.	<i>ʔa-bjaðʔ</i>	‘white’	<i>ma-ḡa:ðʔiḥ</i>	‘scenes’
	<i>ta-nðʔi:m</i>	‘organizing’	<i>ta-mʃi:tʔ</i>	‘combing’
	<i>ta-fsʔi:l</i>	‘cut (of a garment)’	<i>ta-wsʔij-a</i>	‘(on) commission’
	<i>da-t-sʔiḥ</i>	‘it is happening’	<i>da-ðʔ-ðʔajjiḥ</i>	‘she is wasting’
	<i>sta-wʔaḡ</i>	‘he settled down’	<i>ma-afḡasʔ</i>	‘I don’t examine’ <sup>22</sup>

An exception to the above generalization is when the final or initial consonant of the stem is contrastively emphatic, and serves as an onset or a coda of the affix syllable (Bellem 2007:275). Since onsetless syllables are not allowed in Baghdadi, all -V(C) suffixes will syllabify the preceding emphatic consonant as an onset and the whole syllable will be realized with emphasis (47a). For example, upon the addition of a feminine plural affix *-a:t* to a word with a final contrastive emphatic such as *baʔtʔ* ‘ducks COLL’, emphasis will spread into the suffix in *baʔtʔ-a:t* ‘ducks PL’. The same applies to CV- prefixes if an emphatic consonant appears in the coda, as shown in (47b). Prefixes may also be composed of a single consonant in which case they are

<sup>22</sup> In this example, the negative prefix *ma-* is used with the imperfect first person singular form of the verb which otherwise appears with initial /ʔ/ (as in *ʔa-fḡaʔʔ* ‘I examine’). The glottal stop functions as an epenthetic consonant that is dropped here. As a result, the short /a/ of the prefix and that of the verb are pronounced together as a long /a:/ (Erwin 1963:141), but here they are separated by a hyphen to indicate the morpheme boundary.

part of a complex onset with the adjacent emphatic or part of a geminate (after certain assimilations; see §2.3.1), and they will be realized with emphasis (47c).<sup>23</sup>

## (47) The syllable-association requirement

a.	<i>xɑ:l<sup>l̥</sup>-a</i>	‘maternal aunt’	<i>ʔus<sup>ʔ</sup>t<sup>ʔ</sup>ur-a</i>	‘legend’
	<i>fɑðð<sup>ð</sup>-a</i>	‘rude FS’	<i>naft<sup>f</sup>-a</i>	‘his oil’
	<i>ʔal<sup>ʔ</sup>t<sup>ʔ</sup>-a:t</i>	‘mistakes’	<i>xal<sup>ʔ</sup>s<sup>ʔ</sup>-a:n</i>	‘finished MS’
	<i>ð<sup>ð</sup>:b<sup>ð</sup>-eən</i>	‘two officers’	<i>baj<sup>ʔ</sup>l<sup>ʔ</sup>-eən</i>	‘two mules’
	<i>riɣs<sup>ɣ</sup>-ak</i>	‘your dancing’	<i>pas<sup>s</sup>-ak</i>	‘your pass’
	<i>bæðð<sup>ð</sup>-a:wɪ</i>	‘oval’	<i>ħums<sup>s</sup>-a:wɪ</i>	‘from Homs’
b.	<i>ʔa-t<sup>ʔ</sup>fa:l</i>	‘children’	<i>ma-s<sup>ʔ</sup>ʔax</i>	‘slaughterhouse’
	<i>ma-lð<sup>ð</sup>u:m</i>	‘beaded’	<i>ma-s<sup>ʔ</sup>du:ʔ</i>	‘shocked’
	<i>ta-t<sup>ʔ</sup>im</i>	‘vaccination’	<i>ta-s<sup>ʔ</sup>mi:m</i>	‘design’
	<i>sta-t<sup>ʔ</sup>jab</i>	‘he found tasty’	<i>sta-s<sup>ʔ</sup>ʔab</i>	‘he found difficult’
c.	<i>t<sup>ʔ</sup>-t<sup>ʔ</sup>ħin</i>	‘the grinding’	<i>l-lat<sup>ʔ</sup>im</i>	‘the slapping’
	<i>s<sup>ʔ</sup>-s<sup>ʔ</sup>ʔfir</i>	‘the zero’	<i>n-ħas<sup>ʔ</sup>ʔi:ħ-a</i>	‘the advice’
	<i>n-t<sup>ʔ</sup>baq</i>	‘it applied’	<i>n-ð<sup>ð</sup>urab</i>	‘he was struck’
	<i>ð<sup>ð</sup>-ð<sup>ð</sup>:ħar</i>	‘he demonstrated’	<i>s<sup>ʔ</sup>-s<sup>ʔ</sup>a:ħab</i>	‘he became friends’

To summarize, a syllable containing an emphatic trigger /t<sup>ʔ</sup>, s<sup>ʔ</sup>, ð<sup>ð</sup>, l<sup>ʔ</sup>, a/ is necessarily realized with emphasis regardless of intervening morpheme boundaries. Emphasis spread is a fundamentally bidirectional process that is obstructed in the left-to-right direction by non-tautosyllabic non-low front vowels and palatal consonants. Right-to-left and left-to-right ES apply in the stem word domain, and affixes may only become emphatic as a result of the obligatory condition on ES within the syllable. Moreover, a stem-initial or final consonant, if not underlyingly emphatic, will become plain when it syllabifies with an affixal vowel. Before moving to the analysis of ES in BA, let us look into the special phenomenon of /l<sup>ʔ</sup>/ de-emphasis.

3.3.2.3 De-emphasis of /l<sup>ʔ</sup>/

Unlike other Arabic dialects, a lateral emphatic /l<sup>ʔ</sup>/ in Baghdadi is not confined to the word *ʔalʔʔa:h* ‘God’ and its derivatives or to the neighborhood of a low back vowel; and one can reasonably argue for two phonemes /l/ and /l<sup>ʔ</sup>/ that are distinguished by minimal pairs (see (39a–b) above). An important observation in stem words is that /l<sup>ʔ</sup>/ may only be preceded or followed by the back vowels /a(:), u(:), oo/ within a syllable. The fact that /l<sup>ʔ</sup>/ may not be tautosyllabic with stem-internal /i, i:, ee/ is interpreted as a process of de-emphasis triggered by realizations of the front vowel //i//, whereby

<sup>23</sup> The literature varies as to whether emphasis spreads rightwards into consonant-initial suffixes. Most notable is the observation that the suffixal consonant, usually /t/, is optionally realized with emphasis next to an adjacent (homorganic) emphatic /t<sup>ʔ</sup>/, as in *maʔʔat<sup>ʔ</sup>-ta* ~ *maʔʔat<sup>ʔ</sup>-ta* ‘you combed it FS’ (Erwin 1969:73).



the emphatic feature is lost and the surface outcome is a plain /l/.<sup>24</sup> Evidence comes from plain/emphatic alternations between morphologically related words (48).

(48) De-emphasis of onset and coda /l̥/ next to //i//-realizations

<i>ya:li</i>	‘expensive’	<i>ʔa-ɣl̥a</i>	‘more expensive’
<i>θigi:l</i>	‘heavy’	<i>ʔa-θɣal̥</i>	‘heavier’
<i>taxbi:l</i>	‘driving insane’	<i>xabbal̥</i>	‘he drove insane’
<i>ʃiyyi:l</i>	‘hard-working’	<i>ʃaɣl̥-a</i>	‘business’

No de-emphasis of /l̥/ takes place when there is another potential emphatic trigger in the same syllable (49a), as a result of unblocked ES. Moreover, de-emphasis is not operative before tautosyllabically adjacent /i, i:, ee/ of -V(C) suffixes, as shown in (49b). No distinction is made between (non)-triggers of inflectional vs. derivational nature. The seeming contrasts of semantically distinct words in (49c) are actually derived from separate underlying stems with emphatic /l̥/ or plain /l/.

(49) Non-application of /l̥/ de-emphasis

a.	<i>ta-bl̥i:t̥</i>	‘paving’	<i>ʔat̥i:l̥</i>	‘becoming tired’
	<i>ɣal̥i:ð̥</i>	‘thick’	<i>fað̥i:l̥</i>	‘favor’
	<i>xa:l̥is̥</i>	‘pure’	<i>mas̥i:l̥</i>	‘serum’
b.	<i>txam̥l̥-i:n</i>	‘you FS estimate’	<i>θuɣl̥-ee:n</i>	‘two weights’
	<i>xabbal̥-it̥</i>	‘I drove insane’	<i>ɣa:bal̥-it̥</i>	‘you MS met’
	<i>ʃuɣl̥-it̥f̥</i>	‘your FS work’	<i>ɣba:l̥-it̥f̥</i>	‘opposite you FS’
c.	<i>xal̥l̥-i</i>	‘my vinegar’	<i>xall-i</i>	‘leave! MS’
	<i>xa:l̥-i</i>	‘my uncle’	<i>xal-i</i>	‘empty’
	<i>ɣal̥l̥-i</i>	‘fry! FS’	<i>gall-i</i>	‘he told me’

Now that we have identified and characterized the contrastive triggers and blockers of ES in BA, we turn to the featural composition of these segments in the PSM.

### 3.3.3 Features and Representations in BA Emphasis Spread

Based on their secondary articulation, the class of emphatic triggers is marked by a V-place[dor] feature in BA. And since the low back vowel /a/ is the most characteristic segment of emphatic contrasts, it is reasonable to suggest that it is composed exclusively of this feature. Recall from §2.3.1.1 that the emphatic consonants /t̥, s̥, ð̥, l̥/ and their non-emphatic cognates are triggers of *l*-assimilation, classified under the

<sup>24</sup> Exceptions to the tautosyllabicity rule are the derivatives of the word *ʔall̥a:h* when preceded by /i/ (Altoma 1969:14), e.g., *lilla:h* ‘to God’ and *fi:manilla:h* ‘goodbye’. These phrases are probably learned as chunks from religious contexts so that the surface alternations are separately stored in the lexicon with an underlying /l/ phoneme.

natural class of C-place[cor] segments. The emphatic class is differentiated from the plain by way of an extra V-place[dor] feature.

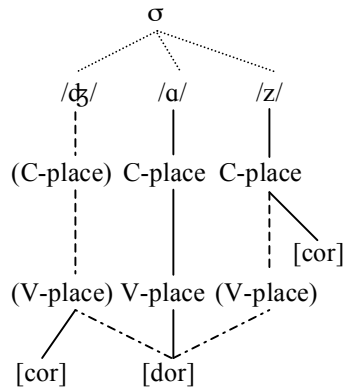
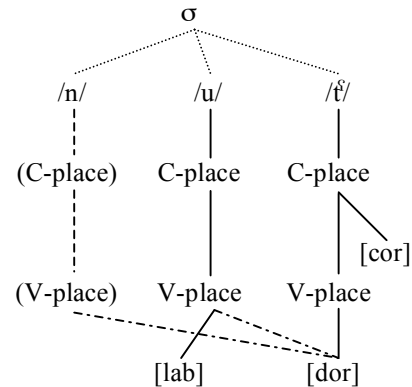
Moreover I have proposed that /t̤/ and /s̤/ are marked for C-manner[closed] and C-manner[open], respectively, while /ð̤/ is mannerless. Given the facts of emphasis spread in this chapter, it is possible to further justify these assumptions as follows. There are three voiceless-voiced-emphatic “triangles” in BA: /t, d, t̤/, /s, z, s̤/, and /θ, ð, ð̤/. /t, d, t̤/ is the only coronal stop triangle in the language. Since /s, z, s̤/ and /θ, ð, ð̤/ may not be featurally identical—as coronal fricatives—and since the pairs /z, ð/ and /s̤, ð̤/ are specified for additional [voice] and V-place[dor] respectively, either /s/ or /θ/ must be a mannerless C-place[cor] segment. Note that the triangles /t, d, t̤/ and /s, z, s̤/ pattern together in that the voiceless segment has a contrastive emphatic cognate and the voiced segment does not. It follows that /t, d, t̤/ and /s, z, s̤/ have manner features. It is then the weakly articulated interdental /θ/ that is just C-place[cor] and /ð/ is the voiced counterpart. Now the emphatic /ð̤/ is also mannerless (neither a stop nor a fricative) but not contrastively voiced (Heselwood 1996:29). This is consistent with the historical fact that OA /ð̤/ has merged with /ð̤/ in Baghdadi, leading to some homophones and two non-emphatic cognates /ð, d/ in the synchronic grammar.

To account for the opacity effects in ES, I follow Clements and Hume (1995) in associating front vowels /j, i, i:, ee/ with a V-place[cor] feature. These front vowels in addition to the palatal consonants /ʃ, tʃ, ʤ/ happen to form the class of ES blockers in BA, a fact interpreted as a dispreference for combining the features V-place[cor] and V-place[dor]. According to Davis (1993:157), a co-occurrence condition between two features is suggestive of a common dominating node, viz., V-place. And since /ee/ is synchronically the outcome of /i/ and /a/ coalescence (§5.3.3), then /i/ is the segment composed only of V-place[cor]. To distinguish these from the consonant blockers, the fricative consonant /ʃ/ has another C-manner[open] feature while the affricates /tʃ, ʤ/ have C-manner[closed]. In §2.3.4.1, we have argued that the palatal consonants /ʃ, tʃ, ʤ/ must have a [cor] feature in order to be triggers of /l/-assimilation. The target of this process /l/ has C-manner[closed] and C-manner[open] plus C-place[cor]. It follows that emphatic /l̤/ has another V-place[dor] feature that is lost upon de-emphasis.

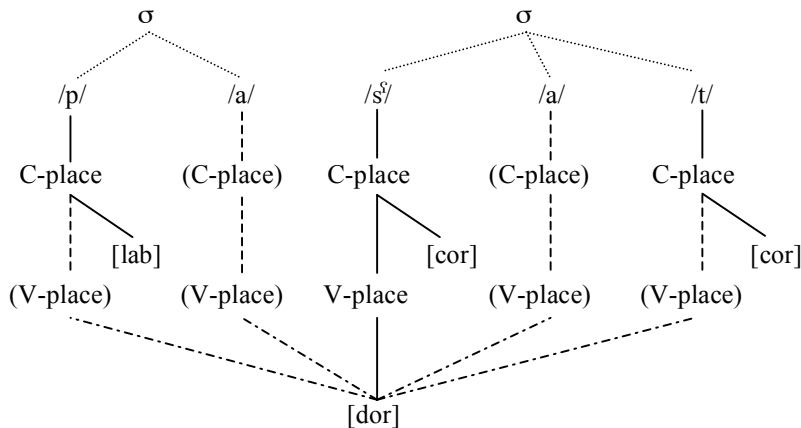
In the remaining part of this section, I shall discuss and illustrate the workings of BA emphasis spread in autosegmental phonology based on the above assumptions and conclusions. Most importantly, I proposed the features V-place[dor] and V-place[cor] to represent the natural classes of ES trigger and opaque segments, respectively. Potential targets are all the segments within the stem word domain. Starting from the simplest structure, the representations in (50a–b) illustrate non-optional ES within the syllable. The data we have seen suggests that once a segment is emphatic, all other segments in the same syllable must also be realized with emphasis, even a segment with a V-place[cor] feature. The illustrations show that the emphatic trigger can be in the nucleus or in the syllable edge (here the coda), and that V-place[dor] spreads to other segments, some of which may project a V-place node (in parentheses) to carry the new emphatic feature. Again, irrelevant manner and laryngeal nodes are excluded.

(50) ES triggers in different syllable positions

a. //ǧazz// → ǧazz

b. //nut<sup>ʕ</sup>t// → nut<sup>ʕ</sup>t

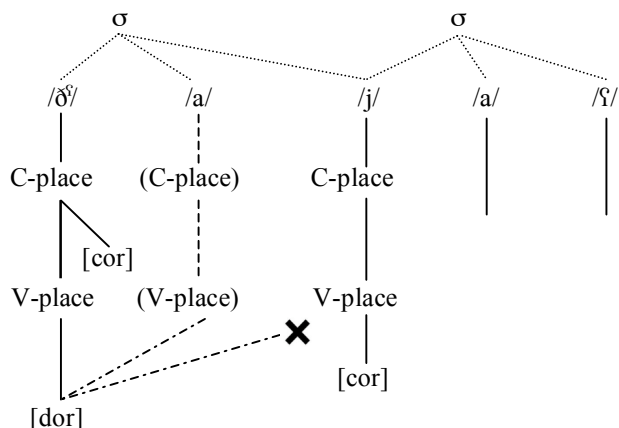
The diagram in (51) suggests a representation for bidirectional ES with no potential blockers. The V-place[dor] terminal feature on the emphatic /s<sup>ʕ</sup>/ spreads leftwards to the beginning of the stem and rightwards until it encounters a morpheme boundary. The vowel-initial suffix *-a:t* will cause the stem-final emphatic trigger to serve as the onset of the suffix syllable, which is also realized with emphasis. In this situation, we can think of an alignment condition within the stem word domain and another within the syllable domain. If the contrastive emphatic is not syllabified with the affix, ES will terminate at the stem word domain.

(51) ES within two domains: //pa:s<sup>ʕ</sup>-a:t// → pa:s<sup>ʕ</sup>-a:t

I proposed that the blocking of ES by non-low front vowels /j, i, i:, ee/ and by palatal consonants /ʃ, tʃ, ǧ/ is due to the feature V-place[cor], which is phonetically antagonistic to the emphatic feature. In other words, there is a condition that prevents any phoneme that is V-place[cor] from also being realized with V-place[dor]. Diagram (52) shows the emphatic feature trying to spread rightwards within the stem word. However, it encounters a non-adjacent V-place[cor] feature on the segment /j/, which prohibits the acquisition of a V-place[dor] feature (indicated by a broken line). And once blocked, the emphatic feature cannot spread to a following or preceding segment

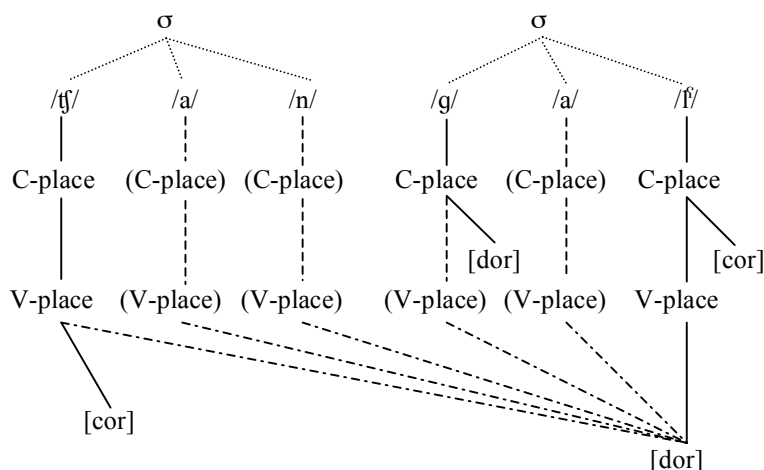
in that syllable or further in the stem word. Geminates will naturally display integrity effects (Hayes 1986a). Thus the true geminate /jj/ in (52), which fills a tautosyllabic coda with the emphatic trigger, fails to undergo emphasis spread because it also fills the onset position of another syllable.

(52) Blocked rightward ES: //  $\delta^{\text{f}}ajja^{\text{f}}$ //  $\rightarrow$   $\delta^{\text{f}}ajja^{\text{f}}$



Leftward ES is never blocked, even if it encounters a non-tautosyllabic segment with a V-place[cor] feature. The autosegmental representation in (53) shows an emphatic trigger /f/ at the rightmost edge of the word. V-place[dor] spreads from right to left in the syllable and on to the adjacent syllable to its left, which contains a potential /tʃ/ blocker. The asymmetry between R-L and L-R spread of emphasis is explained in terms of constraint ranking in the upcoming section.

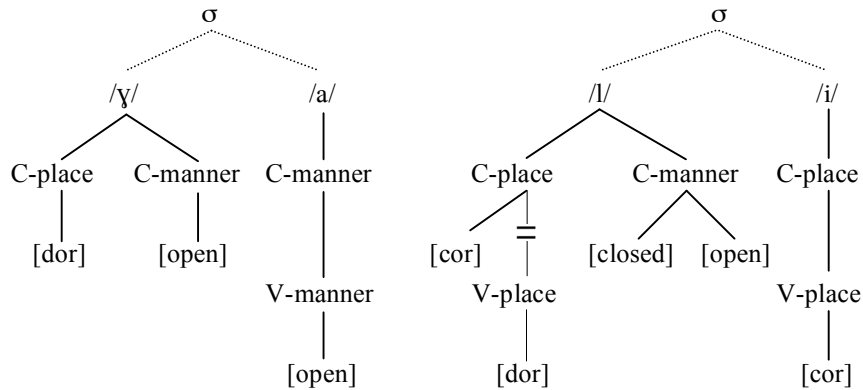
(53) Unblocked leftward ES: //  $tʃaŋga^{\text{f}}$ //  $\rightarrow$   $tʃaŋga^{\text{f}}$



Recall that emphatic /f/ may not be tautosyllabic to stem-internal //i//-realizations. The predictability of non-emphatic /l/ in these environments has been described as de-emphasis. The process is depicted in diagram (54) as a co-occurrence restriction

on adjacent V-place[dor] and V-place[cor] features, which is resolved by losing the emphatic feature to form an output /l/.

(54) De-emphasis of /f/: //ya:fɪ// → ya:li



In sum, this section has justified the relevant features for emphasis spread and their behavior as autosegments. The next step is to formalize these interactions in OT.

### 3.3.4 Constraints and Emphasis Spread in BA

This section attempts to explain the machinery of emphasis spread in Baghdadi in terms of constraint interaction in Optimality Theory. ES is a bidirectional process of V-place[dor] assimilation in the stem word domain, and it generally does not extend into affixes. I propose two alignment constraints (55a–b) to account for R-L and L-R spread of emphasis, which are in essence similar to those used for CA except that the domain of application in BA is limited to the stem (uninflected) word. To eliminate candidates with partial spreading, I assume that the constraints L-ALIGN V-[dor]<sub>STEM</sub> and R-ALIGN V-[dor]<sub>STEM</sub> are gradient as in McCarthy and Prince (1993). If the edge of the V-place[dor] feature is one segment away from a stem edge, it incurs one violation mark; and for every additional segment away an extra violation is incurred.

- (55) a. L-ALIGN V-[dor]<sub>STEM</sub>: The left edge of V-place[dor] must be aligned to the left edge of the stem word.  
 b. R-ALIGN V-[dor]<sub>STEM</sub>: The right edge of V-place[dor] must be aligned to the right edge of the stem word.

These constraints are in conflict with the faithfulness constraint DEPLINK V-[dor] in (56a) against new associations of V-place[dor]. Two other relevant constraints are NOGAP V-[dor] (56b) against spreading “around” the blocker, and MAXLINK V-[dor] (56c) against deletion of an underlying emphatic feature.

- (56) a. DEPLINK V-[dor]: Do not associate V-place[dor] to a segment that did not have it underlyingly.

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- b. NOGAP V-[dor]: The string of segments with a multiply-linked V-place[dor] feature must not be interrupted.
- c. MAXLINK V-[dor]: Every V-place[dor] in the input has a correspondent V-place[dor] in the output.

Tableau (57) gives an example of an emphatic trigger halfway through the stem word. Because ES is uninterrupted, both alignment constraints must be respected, which suggests that they are unranked with respect to one another. They are ranked higher than DEPLINK V-[dor], which is violated each time the emphatic feature spreads to a segment (see McCarthy 1997:235). Candidates (a) through (c) are ruled out because they fail to align V-place[dor] to one of the domain edges; while (d) and (f) satisfy ALIGNMENT at the expense of the high-ranked NOGAP V-[dor] or MAX V-[dor]. The optimal output (57e) is emphatic throughout the whole domain even though it incurs the most violations of DEPLINK V-[dor].

(57) NOGAP V-[dor], MAXLINK V-[dor], L/R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//gas <sup>̣</sup> s <sup>̣</sup> a:b//	NOGAP V-[dor]	MAXLINK V-[dor]	L-ALIGN V-[dor] <sub>STEM</sub>	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	gas <sup>̣</sup> s <sup>̣</sup> a:b			*!*	*!*	
b.	gas <sup>̣</sup> s <sup>̣</sup> a:b			*!*		**
c.	gas <sup>̣</sup> s <sup>̣</sup> a:b				*!*	**
d.	gas <sup>̣</sup> s <sup>̣</sup> a:b	*!				***
e.	gas <sup>̣</sup> s <sup>̣</sup> a:b					****
f.	gassa:b		*!			

Left-to-right emphasis spread is blocked by a subset of vowels and consonants under the natural class of V-place[cor] segments. To account for this, I propose the feature co-occurrence constraint in (58), which poses a restriction on the combination of V-place[dor] and V-place[cor] (cf. \*[HIGH, EMPHATIC] of van de Vijver 1996:252). The interaction of this constraint with ALIGNMENT should reflect the dispreference for emphasis to spread to segments bearing V-place[cor]. And since ES is not blocked by other features, we can assume several lower-ranked co-occurrence constraints against the combination of V-place[dor] with every active feature in the language. These are not included for space reasons. The high-ranked NOGAP—namely, no skipping of potential landing sites—will prevent extending V-place[dor] to subsequent segments. One should also consider the role of the syllable-alignment constraints in (61) below.

- (58) \*V-[cor, dor]: No segment should simultaneously have the features V-place[cor] and V-place[dor].

The relative ranking of ALIGNMENT and \*V-[cor, dor] constraints can be determined if we examine a case of blocked ES. As shown in Tableau (59), the emphatic trigger

at the left edge of the stem assimilates V-place[dor] rightwards until a V-place[cor] segment /j/ is encountered. In (59c) and (59e), ES over/across the potential blocker results in violation of the high-ranked \*V-[cor, dor], while in (59d) ES around the blocker fails on NOGAP V-[dor]. The gradient nature of the alignment constraint becomes useful in this example where the optimal candidate (b) has fewer violation marks than the non-spreading candidate (a). Finally, none of the outputs seems to violate L-ALIGN V-[dor]<sub>STEM</sub>, giving no evidence to its ranking.

- (59) NOGAP V-[dor], MAXLINK V-[dor], \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//ð <sup>h</sup> ajjaʕ//	NOGAP V-[dor]	MAXLINK V-[dor]	*V- [cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	ð <sup>h</sup> ajjaʕ				****!	
☞ b.	ð <sup>h</sup> ajjaʕ				***	*
c.	ð <sup>h</sup> ajjaʕ			*!	**	****
d.	ð <sup>h</sup> ajjaʕ	*!				***
e.	ð <sup>h</sup> ajjaʕ			*!		****
f.	ðajjaʕ		*!			

The ranking of L-ALIGN V-[dor]<sub>STEM</sub> becomes relevant when we consider the inability of V-place[cor] to block R-L emphasis spread. The optimal candidate in Tableau (60) spreads the emphatic feature leftwards over a syllable containing /ʃ/, thus violating \*V-[cor, dor]. In order to eliminate an output where /ʃ/ blocks ES (60b), L-ALIGN V-[dor]<sub>STEM</sub> must outrank \*V-[cor, dor]. Potential outputs (c) through (e) incur non-fatal violations of the latter constraint, and it is up to R-ALIGN V-[dor]<sub>STEM</sub> and NOGAP V-[dor] to decide which one is the winner. Moreover, to eliminate candidate (60f), we must establish the crucial ranking: MAXLINK V-[dor] >> \*V-[cor, dor].<sup>25</sup>

- (60) NOGAP V-[dor], L-ALIGN V-[dor]<sub>STEM</sub>, MAXLINK V-[dor] >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor] (cf. McCarthy 1997:235)

	//ʃat <sup>h</sup> ʕaf//	NOGAP V-[dor]	L-ALIGN V-[dor] <sub>STEM</sub>	MAXLINK V-[dor]	*V- [cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	ʃat <sup>h</sup> ʕaf		*!*			**	
b.	ʃat <sup>h</sup> ʕaf		*!*				**
c.	ʃat <sup>h</sup> ʕaf				*	*!*	**
d.	ʃat <sup>h</sup> ʕaf	*!			*		***
☞ e.	ʃat <sup>h</sup> ʕaf				*		****
f.	ʃattaf			*!			

<sup>25</sup> The constraint NOGAP V-[dor] is inviolable in BA. And for simplification, it will be excluded from subsequent tableaux except in the case of multiple triggers.

Besides the stem domain, it seems that the emphatic feature always coincides with syllable boundaries. Section 3.3.2.2 identified at least four facts of ES that bear on this *syllable association* requirement: (i) ES is not blocked in a word where a V-place[cor] segment is tautosyllabic to the emphatic trigger; (ii) once rightward ES is blocked by a non-tautosyllabic segment bearing V-place[cor], every segment in that syllable will surface as non-emphatic; (iii) an affix may be realized as emphatic if it is syllabified with the emphatic trigger in the onset or coda positions; and (iv) a target segment from the stem may lose the emphatic feature if it is syllabified with an affix. In a constraint-based grammar, I generalize this syllable requirement as two gradient constraints that align V-place[dor] to the left and right edges of the syllable. These are formulated in (61a–b).

(61) a. L-ALIGN V-[dor]σ: The left edge of V-place[dor] must be aligned to the left edge of the syllable.

b. R-ALIGN V-[dor]σ: The right edge of V-place[dor] must be aligned to the right edge of the syllable.

For a tautosyllabic V-place[cor] feature to be a target of ES, the constraint R-ALIGN V-[dor]σ must be ranked above \*V-[cor, dor].<sup>26</sup> In the following tableau, potential outputs (62a) and (62c) are ruled out because they do not align V-place[dor] to the right edge of the first and second syllables, respectively. (62e) incurs a fatal violation of MAXLINK V-[dor]. Both (62b) and (62d) violate \*V-[cor, dor] and satisfy R-ALIGN V-[dor]σ. It is the lower ranked R-ALIGN V-[dor]<sub>STEM</sub> that selects the fully spreading (62d) as the optimal output.

(62) L/R-ALIGN V-[dor]σ, L-ALIGN V-[dor]<sub>STEM</sub>, MAXLINK V-[dor] >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//s <sup>i</sup> ixɑ//	L-ALIGN V-[dor]σ	R-ALIGN V-[dor]σ	L-ALIGN V-[dor] <sub>STEM</sub>	MAXLINK V-[dor]	*V- [cor, dor]	R-ALIGN V- [dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	s <sup>i</sup> .xɑ		*!				***	
b.	s <sup>i</sup> .xɑ					*	*!*	*
c.	s <sup>i</sup> .xɑ		*!			*	*	**
d.	s <sup>i</sup> .xɑ					*		***
e.	si.xɑ				*!			

<sup>26</sup> By analogy, L-ALIGN V-[dor]σ also outranks \*V-[cor, dor] in cases where an emphatic trigger in the coda spreads to (and beyond) a preceding V-place[cor] segment. However, this function can also be carried out by the undominated L-ALIGN V-[dor]<sub>STEM</sub> constraint. A separate tableau is not presented to avoid repetition.



Let's consider an example that combines consequences (ii) and (iii) above. In Tableau (63), the inviolability of L-ALIGN V-[dor] $\sigma$  guarantees that the prefix *ta-* will surface with emphasis, especially that output (d) does not violate ALIGNMENT to the stem. On the other hand, R-ALIGN V-[dor] $\sigma$  will ensure that V-place[dor] is delinked from the onset /t/ of the blocked rightmost syllable. Upon evaluating the remaining candidates, (63b) is superior to its competitors because of its compliance with \*V-[cor, dor] and MAXLINK V-[dor]. Here the optimal output exhibits leftward spread of V-place[dor] within the syllable domain on to the prefix, while rightward spread is blocked in the stem.<sup>27</sup>

(63) L/R-ALIGN V-[dor] $\sigma$ , L-ALIGN V-[dor]<sub>STEM</sub>, MAXLINK V-[dor] >> \*V-[cor, dor]  
>> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//ta-t <sup>̂</sup> i:m//	L-ALIGN V-[dor] $\sigma$	R-ALIGN V-[dor] $\sigma$	V-[dor] <sub>STEM</sub> L-ALIGN	MAXLINK V-[dor]	*V- [cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	<i>ta<sup>̂</sup>t<sup>̂</sup>i:m</i>	*!*					***	
b.	<i>ta<sup>̂</sup>t<sup>̂</sup>i:m</i>						***	**
c.	<i>ta<sup>̂</sup>t<sup>̂</sup>i:m</i>		*!*				**	***
d.	<i>ta<sup>̂</sup>t<sup>̂</sup>i:m</i>	*!*				*		**
e.	<i>ta<sup>̂</sup>t<sup>̂</sup>i:m</i>					*!		*****
f.	<i>ta<sup>̂</sup>t<sup>̂</sup>i:m</i>				*!			

In order to account for the de-emphasis of /t<sup>̂</sup>/ by contiguous and tautosyllabic stem //i//-realizations, I use the same adjacency restriction constraint proposed for CA, viz., \*{V-[cor]<sub>STEM</sub> L-[dor]} $\sigma$ . Once again, this is a conjunction of the same co-occurrence constraints on adjacent features within the syllable domain: \*V-[cor]<sub>STEM</sub> V-[dor], \*V-[cor]<sub>STEM</sub> C-[closed] and \*V-[cor]<sub>STEM</sub> C-[open]. The curly brackets in the notation indicate the reversible order of the features in the syllable domain. This formulation in (64) predicts that /t<sup>̂</sup>/ is the only target of de-emphasis, since no other segment in BA combines V-place[dor], C-manner[closed], and C-manner[open] features. On the other hand, de-emphasis implies violation of MAXLINK V-[dor] in (56c).

(64) \*{V-[cor]<sub>STEM</sub> L-[dor]} $\sigma$  (shorthand): V-place[cor] on a stem segment cannot co-occur adjacent to V-place[dor], C-manner[closed], and C-manner[open] in the syllable domain.

<sup>27</sup> The domain of ES in Baghdadi is the stem word, and generally neither leftward nor rightward ES extends to affixes. In case the trigger is not syllabified with the affix, multiple violations of DEPLINK V-[dor] will select the correct output (no need to propose a high ranking positional faithfulness constraint against spreading V-place[dor] across a morpheme boundary). Also, there is no mention in the literature that ES targets segments beyond the word boundary in BA (compare to CA). This could be due to different syllable structure requirements, especially that BA tolerates consonant clusters in the onset and does not allow them in the coda, with consequences for re-syllabification in the phrase.

### 3. EMPHASIS SPREAD

Tableau (65) examines a word in which /*l̥*/ is de-emphatic in the onset of a syllable with /i/ in the nucleus, *ya:li* ‘expensive’ (but comparative *?a-yl̥a*). The constraint \*V-[cor, dor] is violated for each emphatic /i/. The performance of the optimal output (e) on MAXLINK V-[dor] is inconsequential, in so far as this constraint is outranked by \*{V-[cor]<sub>STEM</sub> L-[dor]}σ and L/R-ALIGN V-[dor]σ. De-emphasis is attained.

(65) L/R-ALIGN V-[dor]σ, L-ALIGN V-[dor]<sub>STEM</sub>, \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor] >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//ya:l̥i //	R-ALIGN V-[dor]σ	L-ALIGN V-[dor] <sub>STEM</sub>	*{V-[cor] <sub>STEM</sub> L-[dor]}σ	MAXLINK V-[dor]	*V-[cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	<i>ya:l̥i</i>	*!*	*!*	*!			**	
b.	<i>ya:l̥i</i>		*!*	*!		*		**
c.	<i>ya:l̥i</i>	*!*					**	**
d.	<i>ya:l̥i</i>			*!		*		****
e.	<i>ya:li</i>				*			

Limiting the occurrence of V-place[cor] to stem segments ensures the right triggers. Tableau (66) provides an example with an underlying /*l̥*/ that does not undergo de-emphasis when V-place[cor] is attached to the 1SG possessive inflectional suffix *-i*. Consequently, the constraint \*{V-[cor]<sub>STEM</sub> L-[dor]}σ is irrelevant and it is up to MAXLINK V-[dor] and ALIGNMENT to decide the winner. The optimal candidate (d) must be faithful to the underlying V-place[dor] feature, which spreads throughout the word domain.

(66) L/R-ALIGN V-[dor]σ, L-ALIGN V-[dor]<sub>STEM</sub>, \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor] >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//xa:l̥i-i //	L-ALIGN V-[dor]σ	R-ALIGN V-[dor]σ	L-ALIGN V-[dor] <sub>STEM</sub>	*{V-[cor] <sub>STEM</sub> L-[dor]}σ	MAXLINK V-[dor]	*V-[cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	<i>xa:l̥i-i</i>		*!	*!*				*	
b.	<i>xa:l̥i-i</i>			*!*			*		*
c.	<i>xa:l̥i-i</i>	*!		*!			*		**
d.	<i>xa:l̥i-i</i>						*		***
e.	<i>xa:lli</i>					*!			

Recall that de-emphasis of the underlying emphatics //t̥, s̥, δ̥// is not allowed. This obtains if we deploy MAXLINK V-[dor]. However, the latter constraint is insufficient in cases of multiple potential triggers composed of /*l̥*/ and one of the other emphatics.

I propose the three MAXLINK constraints in (67a–c) which penalize deletion of V-place[dor] from /t̪, s̪, ð̪/, i.e., from segments bearing a single C-manner[closed], a single C-manner[open], or a feature [voice], respectively. This type of class-specific (positional) faithfulness constraints has been used in Morén (2006:1240).

- (67) a. MAXLINK V-[dor]<sub>STOP</sub>: Every V-place[dor] feature associated with C-manner [closed] in the input has a correspondent in the output.
- b. MAXLINK V-[dor]<sub>FRIC</sub>: Every V-place[dor] feature associated with C-manner [open] in the input has a correspondent in the output.
- c. MAXLINK V-[dor]<sub>VOICE</sub>: Every V-place[dor] feature associated with [voice] in the input has a correspondent in the output.

A case of multiple potential triggers is examined in Tableau (68). In *fā.ð̪il̪* ‘favor’, /i/ is inactive both as a blocker of ES from /ð̪/ and as a trigger of /f̪/ de-emphasis. Output (68c), which violates \*V-[cor, dor] and \*{V-[cor]<sub>STEM</sub> L-[dor]}σ, emerges as optimal. Hence, the latter constraint must be outranked by MAXLINK V-[dor]<sub>VOICE</sub> to rule out the option of a de-emphatic /ð̪/ (68e). It must also be outranked by the NOGAP V-[dor] and alignment constraints (in the syllable or stem domains).

- (68) NOGAP V-[dor], MAXLINK V-[dor]<sub>STOP/FRIC/VOICE</sub>, L/R-ALIGN V-[dor]σ, L-ALIGN V-[dor]<sub>STEM</sub> >> \*{V-[cor]<sub>STEM</sub> L-[dor]}σ >> MAXLINK V-[dor] >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK V-[dor]

	//fāð̪il̪//	NOGAP V-[dor]	MAXLINK V-[dor] <sub>VOICE</sub>	R-ALIGN V-[dor]σ	L-ALIGN V-[dor] <sub>STEM</sub>	*{V-[cor] <sub>STEM</sub> L-[dor]}σ	MAXLINK V-[dor]	*V-[cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEPLINK V-[dor]
a.	fā.ð̪il̪ <sup>f</sup>	*!			*!*	*				
b.	fā.ð̪il̪ <sup>f</sup>				*!*	*		*		*
c.	fā.ð̪il̪ <sup>f</sup>					*		*	**	***
d.	fā.ð̪il̪			*!*			*			**
e.	fā.ð̪il̪		*!				**			

The same ranking selects the correct output in *s̪āli:b* ‘cross’, where /i/ is simultaneously a blocker of ES from /s̪/ and a trigger of /l̪/ de-emphasis. In Tableau (69), the optimal candidate (d) violates MAXLINK V-[dor], but the more fatal violations of MAXLINK V-[dor]<sub>FRIC</sub> and ALIGNMENT rule out potential outputs with de-emphatic /s̪/ or with incomplete ES. Because markedness constraints may not refer to the underlying form, no distinction is made between emphatic /l̪/ and emphasized /l̪/ when it

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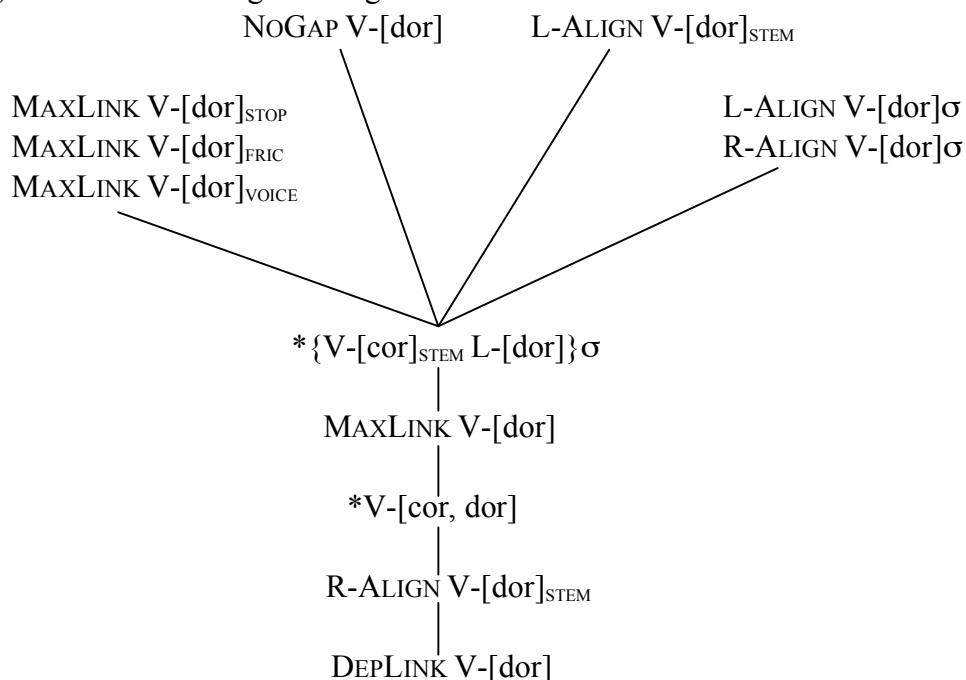
comes to violations of  $*\{V-[\text{cor}]_{\text{STEM}} L-[\text{dor}]\}\sigma$ , which is also ranked above MAXLINK V-[\text{dor}] to enforce the blocking effect.

- (69) NOGAP V-[\text{dor}], MAXLINK V-[\text{dor}]<sub>STOP/FRIC/VOICE</sub>, L/R-ALIGN V-[\text{dor}]\sigma, L-ALIGN V-[\text{dor}]<sub>STEM</sub> >>  $*\{V-[\text{cor}]_{\text{STEM}} L-[\text{dor}]\}\sigma$  >> MAXLINK V-[\text{dor}] >>  $*V-[\text{cor}, \text{dor}]$  >> R-ALIGN V-[\text{dor}]<sub>STEM</sub> >> DEPLINK V-[\text{dor}]

	//sʕaʕi:b//	NOGAP V-[\text{dor}]	MAXLINK V-[\text{dor}] <sub>FRIC</sub>	R-ALIGN V-[\text{dor}]\sigma	L-ALIGN V-[\text{dor}] <sub>STEM</sub>	$*\{V-[\text{cor}]_{\text{STEM}} L-[\text{dor}]\}\sigma$	MAXLINK V-[\text{dor}]	$*V-[\text{cor}, \text{dor}]$	R-ALIGN V-[\text{dor}] <sub>STEM</sub>	DEPLINK V-[\text{dor}]
a.	sʕa.ʕi:b	*!		*!*		*			**	
b.	sʕa.ʕi:b			*!		*			**	*
c.	sʕa.ʕi:b					*!		*		****
d.	sʕa.li:b						*		***	*
e.	sʕa.li:b			*!			*		****	
f.	sa.li:b		*!				**			

The ranking hierarchy for emphasis spread in Baghdadi is summarized in the Hasse diagram below. These complex phenomena that fall out from a simple ranking are perhaps not so easy to unify using either traditional features or rule-based approaches.

- (70) Constraint rankings for Baghdadi ES



### 3.4 Conclusion

This chapter investigated the process of emphasis spread in Cairene and Baghdadi Arabic. ES is a widespread phenomenon in Arabic dialects that spawned a wide range of analyses on the phonological level. I pursue an interpretation of ES as a process of place assimilation whereby a V-place[dor] feature spreads bidirectionally from an emphatic segment to other segments in a given domain and subject to a number of factors. While these factors are the source of variation between CA and BA, many of the answers proposed apply equally to both dialects, as well as to other dialects of Arabic not examined here. Two important variables are the identity of the contrastive emphatic triggers and the domain of spread of the emphatic feature.

The status of the coronal emphatic consonants as phonemes is easily established: first because they occur in all vocalic environments, and second because they often contrast with their non-emphatic cognates. In addition, these emphatic consonants do participate in other assimilatory processes (see chapters 2 and 4). Both dialects have the emphatics /t̤/, s̤/, and CA has /d̤/, z̤/ which correspond to a historically merged /ð̤/ in BA. The emphatic liquids—/r̤/ in CA and /ʕ̤/ in BA—are not fully independent phonemes since they undergo de-emphasis next to /i/, but they are still contrastive. On the other hand, a contrast is assumed between an emphatic /a/ and a non-emphatic (front) /a/ in both CA and BA. Recognizing a low vowel split allows us to exclude the class of secondary emphatics, which are restricted to an /a/ environment. This makes the current analysis more economical than previous ones.

We have seen that these contrastive phonemes trigger leftward and rightward ES, subject to certain segmental and prosodic conditions. Emphasis in CA extends over all segments in the prosodic word to the left or to the right of the trigger, including any prefixes and suffixes. In BA, there is a discrepancy between the unbounded leftward ES and rightward ES which is blocked by non-tautosyllabic front vowels and palatals (grouped under V-place[cor]). The domain of spread is generally narrower in BA, viz., the stem word, and affixes are pronounced non-emphatically. Segments beyond the domain boundary (stem in BA and prosodic word in CA) are realized with emphasis only if they are in the same syllable as the emphatic trigger. So, reference to syllable structure is necessary in characterizing the domain of ES in both dialects.

In Optimality Theory, which I adopt as the analytical framework in this study, a change from an input to a surface form is usually in compliance with a high-ranked markedness constraint, at the expense of violating some faithfulness constraint(s). If we treat features as autosegments, then assimilation in the EVAL function of OT can be viewed in terms of markedness constraints that favor certain types of feature geometric structure. I proposed two alignment constraints to motivate bidirectional spread of V-place[dor] in the relevant domain. Thus from an input that contains an underlying emphatic segment, an output in which all other segments in the domain acquire the emphatic feature is superior to the input-faithful alternative. In order to capture phonological asymmetries in the Cairene and Baghdadi grammars, various other markedness and faithfulness constraints are integrated in the hierarchy.



## CHAPTER 4

### Labialization

#### 4.1 Background

Labialization is usually defined as a process of assimilation by which rounded vowels trigger a corresponding secondary articulation on adjacent consonants. The reverse impact, by which certain consonants (or glides) cause neighboring vowels to appear rounded, may be called “vocalic labialization” or simply “rounding”. This latter type will be the focus of the present chapter. And despite the above distinction, I will use the general term “labialization” to refer to all these types of assimilation.

Rounding triggered by a labio-velar glide /w/ is straightforward. Given that high vowels and glides have identical featural content (at least in some languages), the assimilation in question involves spreading vocalic features from an onset or coda position to a nucleus. On the other hand, rounding triggered by labial consonants is a widely attested sound change. This assimilatory C-V effect can be explained in terms of a single cover feature [labial] (see Kenstowicz and Kisseberth 1979:251). Another interesting correlation is that between rounded vowels and emphatic consonants. In *Ṣan‘ānī* Arabic, for instance, vocalic labialization spreads primarily rightwards from an emphatic to all short high front vowels in the phonological word (Watson 1996, 1999). The close affinity between emphatic-ness and rounding has been attributed to their common acoustic effect of lowering  $F_2$  frequency. In other Arabic dialects, such as *Baghdadi*, short high vowels are realized as /u/ owing to the collective influence of neighboring labial and emphatic/velar consonants.

This chapter concentrates on certain morphological categories in *Cairene* and *Baghdadi* where the contrast between the short high vowels /i/ and /u/ is neutralized. Labialization in these classes is contingent on the presence of an underlying //i// or an unspecified (e.g., epenthetic) vowel. One major conclusion is that surface /u/ in CA has a single distinctive feature [lab], while in BA it combines both [lab] and [dor]. The implication is that distinctive features are not as rigid as most models of feature geometry propose. Two other theoretical issues addressed are cross-category C-to-V assimilation effects and locality in spreading.

## 4.2 Labialization in Cairene Arabic

Cairene Arabic exhibits a process of labialization in which underlying //i// surfaces as /u/ following or preceding the labio-velar glide /w/ within certain contexts. It may also surface as /a/ before guttural consonants /ʔ, h, ħ, ʕ/. These partial neutralizations offer some evidence for the feature-geometric representation of these contrastive segments. Specifically, I argue that labialization involves spreading of a V-place[labial] feature, which characterizes the high back vowel /u/ and its glide counterpart /w/. The /a/-triggers, on the other hand, are characterized by a manner feature [open] which may be dominated by a C- or a V- node.

The discussion is organized as follows. Section 4.2.1 presents the data (elicited from two female native speakers of Cairene) and distributional patterns. Section 4.2.2 provides featural composition and autosegmental representations of the participating segments. Finally, section 4.2.3 develops an OT analysis that accounts for the assimilation patterns.

### 4.2.1 Labialization within Nouns and Prefixes

Minimal pairs contrasting short /i~/u/ in CA are rare but attested, e.g., *ʔilla* ‘scarcity’ vs. *ʔulla* ‘earthenware jug’ (Woidich 1980:207). Interestingly, a stem vowel //i// may surface as /u/ after initial /w/, but the process has been described as optional (Woidich 2006a:20). In fact, labialization of this sort is more prominent in the speech of some speakers and not others, and it is characteristic of connected speech. As exemplified in (1a–b), it may apply to nouns and verbs within some obscure phonological phrase but not in citation form. The trigger must be word-initial.

#### (1) Labialization following word-initial /w/ in nouns, adjectives, and verbs

- |    |                |                   |   |                            |                               |
|----|----------------|-------------------|---|----------------------------|-------------------------------|
| a. | <i>wist</i>    | ‘middle’          | ~ | <i>wust i l-balad</i>      | ‘downtown’                    |
|    | <i>wisʕ</i>    | ‘spaciousness’    | ~ | <i>ʔil-fustan fi: wusʕ</i> | ‘the dress can be let out’    |
|    | <i>wirk</i>    | ‘thigh’           | ~ | <i>ʔidini l-wurk</i>       | ‘give me the thigh (chicken)’ |
|    | <i>wirs</i>    | ‘inheritance’     | ~ | <i>xad il-beet wurs</i>    | ‘he inherited the house’      |
|    | <i>wizr</i>    | ‘sin’             | ~ | <i>ʕalik wuzr</i>          | ‘you have sinned’             |
|    | <i>wing</i>    | ‘wing (football)’ | ~ | <i>ʔil-wung iʃʃima:l</i>   | ‘the left wing’               |
|    | <i>widn</i>    | ‘ear’             | ~ | <i>wudn i kbira</i>        | ‘a big ear’                   |
|    | <i>wila:da</i> | ‘birth’           | ~ | <i>fi l-wula:da</i>        | ‘in labor’                    |
| b. | <i>wiliʕ</i>   | ‘it caught fire’  | ~ | <i>ʔin-ʔarʕ wulʕit fi:</i> | ‘he caught fire’              |
|    | <i>wiʔif</i>   | ‘he stood’        | ~ | <i>wuʔif sa:bit</i>        | ‘he stood still’              |
|    | <i>wisʕil</i>  | ‘he arrived’      | ~ | <i>wusʕil badri</i>        | ‘he arrived early’            |
|    | <i>wisix</i>   | ‘dirty’           | ~ | <i>ʔibn il-wusxa</i>       | ‘son of a whore’              |
|    | <i>witʕi</i>   | ‘it decreased’    | ~ | <i>sʕutʕu wutʕi</i>        | ‘his voice became quieter’    |
|    | <i>wisiʕ</i>   | ‘it widened’      | ~ | <i>ʔig-gazma wusʕit</i>    | ‘the shoe became too wide’    |
|    | <i>wizin</i>   | ‘he weighed’      | ~ | <i>wuznit kilu ruzz</i>    | ‘she weighed a kilo of rice’  |



Likewise, short //i// stem vowels may surface as /u/ before a labio-velar /w/ whether or not the two are tautosyllabic. This sort of labialization is consistent in the speech of educated speakers of Cairene in both slow and fast speech.<sup>2</sup> The data set in (2) shows a broken plural pattern in which the vowel preceding /w/ is always realized as /u/. In order to find synchronic evidence that such forms have an underlying //i//, we have to consider the surface /oo/ of the singular as underlyingly //au// (see §5.2.3), where a glide replaces C<sub>2</sub> of the defective root; and we get the pattern CaWCa. By examining *sound* roots (namely, those without glide components) of the same pattern, such as *gazma* ‘shoe’ and *farda* ‘one of a pair’, we find that their broken plural contains /i/ before C<sub>2</sub>, as in *gizam* and *firad*.

(2) Labialization preceding non-word-initial /w/

<i>singular</i>	<i>plural</i>	<i>gloss</i>
ʔoðdʔa	ʔuwaðf	‘rooms’
koqrʔa	kuwaqrʔ	‘balls’
tooka	tuwak	‘hairpins’
gooza	guwaz	‘water pipes’
sʔoðba	sʔuwaðb	‘greenhouses’
koofa	kuwaf	‘wedding daises’
kooma	kuwam	‘piles’
mooza	muwaz	‘shins (of meat)’
nooba	nuwab	‘fits’
fʔu:tʔa	fʔuwa:tʔ	‘towels’

A similar non-optional pattern is observed in the final vowel of the participle prefix *mi-*, which exhibits a complementary distribution between /u/, /a/, or /i/ depending on the following consonant. This is clearly phonological since it does not apply to other CV- prefixes (such as the second person singular *ti-* or the first person plural *ni-*). The prefixal vowel will surface as /u/ before /w/, and as /a/ before a pharyngeal /ħ, ʕ/ or a laryngeal /ʔ, h/, as shown in (3a–b). Any other consonant as the first radical results in /i/. Note that in fast speech the vowel may seem to disappear, but this cannot be the case phonologically since CA does not allow consonant clusters in the onset (Abdel-Massih 1975:25). Even when the vowel is phonetically reduced, it keeps its original distinctive “color”.

(3) Complementary distribution in the participle prefix *mi-*

a.	<i>mu-wallaʕ</i>	‘catching fire’	<i>mu-wassaʕ</i>	‘making room’
	<i>mu-waggib</i>	‘showing respect’	<i>mu-waðdʔab</i>	‘preparing’
	<i>mu-waʕwif</i>	‘whispering’	<i>mu-waðdʔaħ</i>	‘clarifying’
	<i>mu-waħħid</i>	‘uniting’	<i>mu-wassax</i>	‘dirty’

<sup>1</sup> We may generalize that uneducated speakers (especially females) use /i/ instead of /u/ in their pronunciation of the words in (2). This was confirmed by input from an earlier illiterate informant.

	<i>mu-wakkil</i>	‘appointing’	<i>mū-waṭṭī</i>	‘lowering’
	<i>mu-warri</i>	‘showing’	<i>mu-wannis</i>	‘keeping company’
	<i>mū-waffār<sup>f</sup></i>	‘saving’	<i>mū-wazzāf<sup>f</sup></i>	‘employee’
b.	<i>ma-habbib</i>	‘lousy’	<i>ma-ḥajjās<sup>f</sup></i>	‘enjoying himself’
	<i>ma-ʔammin</i>	‘securing’	<i>ma-ʔaḡḡar<sup>f</sup></i>	‘crude’
	<i>ma-ʔallif</i>	‘composing’	<i>ma-ʔaggin</i>	‘of doughy consistency’
	<i>ma-ʔallim</i>	‘title of address’	<i>ma-ʔabbār<sup>f</sup></i>	‘showing consideration’
	<i>ma-ḥammad</i>	‘Muhammad’	<i>ma-ḥammil</i>	‘carrying’
	<i>ma-ḥaddid</i>	‘defining’	<i>ma-ḥammar<sup>f</sup></i>	‘fried’
c.	<i>mi-ballim</i>	‘sullen’	<i>mi-tannaḥ</i>	‘mulish’
	<i>mi-gabbis</i>	‘plastered’	<i>mi-xazzin</i>	‘storing’
	<i>mi-dahwil</i>	‘messed up’	<i>mi-rʔabbāʔ</i>	‘square’
	<i>mi-zannaʔ</i>	‘crowded’	<i>mi-ʃammar</i>	‘rolled up’
	<i>mi-dʔallim</i>	‘dark’	<i>mi-tʔannif</i>	‘ignoring’
	<i>mi-zʔabbāʔ<sup>f</sup></i>	‘adjusted’	<i>mi-ʔalli</i>	‘raising prices’
	<i>mi-fawwaʔ</i>	‘awaken’	<i>mi-kammil</i>	‘completing’
	<i>mi-lawwin</i>	‘colored’	<i>mi-maddid</i>	‘stretched’
	<i>mi-najjil</i>	‘lousy’	<i>mi-ʔaṣṣar<sup>f</sup></i>	‘easing’

We have seen in (1) and (2) that labialization of //i// does apply morpheme-internally. However, the change from //i// to /a/ before /ʔ, h, ḥ, ʕ/ is a morpheme-specific process (restricted to the prefix *mi-*). As shown in (4), morpheme-internal sequences identical to those in (3b) fail to undergo the shift.

(4) Non-assimilating /i/ before /ʔ, h, ḥ, ʕ/

<i>mihna</i>	‘profession’	<i>giha:d</i>	‘struggle’
<i>miʔda:r<sup>f</sup></i>	‘quantity’	<i>ʔihna</i>	‘we’
<i>miḥna</i>	‘hardship’	<i>biḡiḥ</i>	‘impudent’
<i>fiʕlan</i>	‘actually’	<i>giʕirr</i>	‘good-for-nothing’

These complementary distributions have received no attention in the literature, yet they seem to have significant implications for the feature geometry of Cairene Arabic, as discussed in the next section.

#### 4.2.2 Features and Representations in CA Labialization

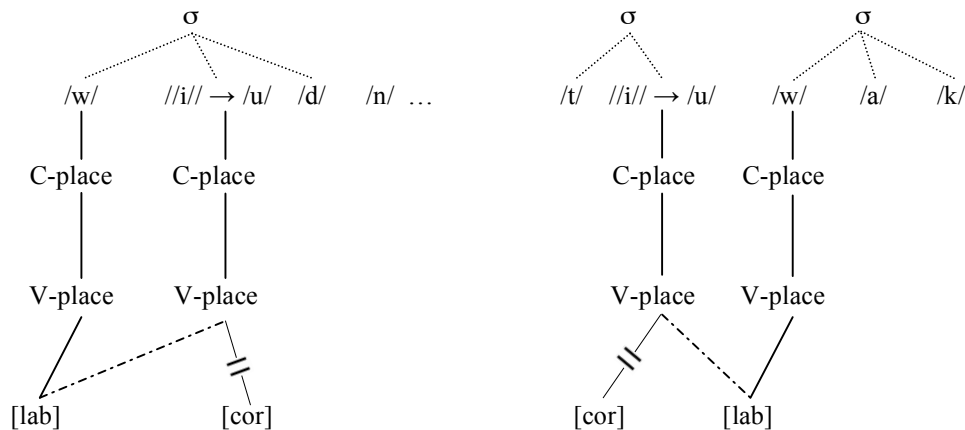
Labialization in some CA nouns and prefixes is triggered by an adjacent labio-velar glide /w/. That labial consonants in CA are not triggers of labialization/rounding is evidence for two distinctive features: C-place[lab] and V-place[lab]. Thus, I argue that /u/ (and its glide counterpart /w/) is composed of a single V-place[lab]. Its velar articulation is claimed to be a phonetic enhancement effect (van de Weijer 2011).

Let us first examine labialization sponsored by a non-syllabic /w/, targeting the preceding or following /i/ nucleus. Progressive labialization is restricted to triggers in the word-initial (onset) position, which enjoys a special status within a number of phonological phenomena (Beckman 1998:19 ff.). The target is the following short //i// nucleus specified for V-place[cor]. The [labial] feature of the trigger spreads to the V-place node of the target and the original V-place[cor] feature is delinked (5a). In the more common regressive labialization, the trigger may belong to the onset or coda. The target is the preceding nucleus specified for V-place[cor], and the spreading mechanism is essentially the same as in progressive labialization, as in (5b). The process applies in the prosodic word domain, including within one morpheme (2) or across morpheme boundaries (3a). The failure of underlyingly bimoraic V-place[cor] vowels to labialize in the same environments (Watson 2002:265) is explained via constraint interaction (§4.2.3).

(5) Progressive and regressive labialization from /w/

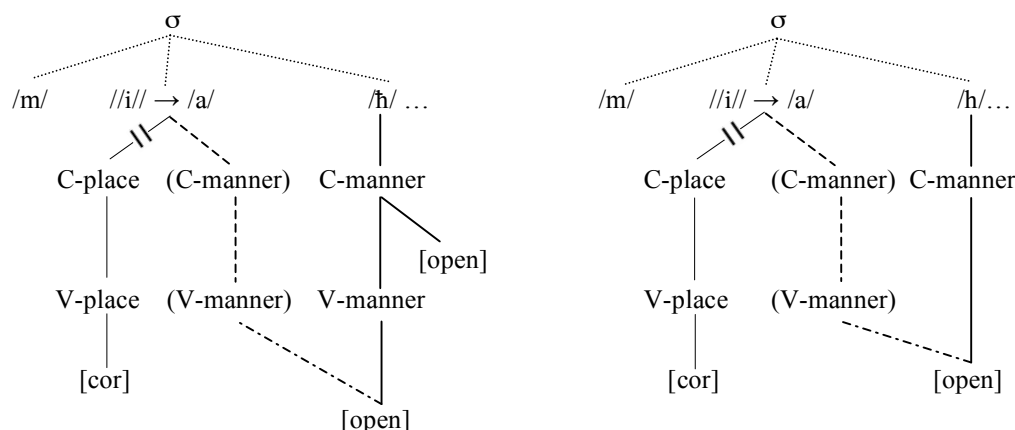
a. //widn kbira// → wudn i kbira

b. //tiwak// → tuwak



The vowel /i/ in the complementary distribution pattern in (3) is either underlying or supplied by a default fill-in mechanism, but it involves no spreading of V-place[cor]. The /a/-contexts do not involve place assimilation, but they will be examined here because they overlap with labialization. Triggers are the gutturals (laryngeal plus pharyngeal) /ʔ, h, ħ, ʕ/, and apart from /ʔ/, they have fricative-like or approximant-like constriction. In §2.2.3.1, I hypothesized that the pharyngeals /ħ, ʕ/ constitute a natural class of (placeless) segments with C-manner[open] (being fricative-like) and V-manner[open] (being approximant-like). The connection between these two consonants and the front (non-emphatic) low vowel /a/ has articulatory grounds: /a/ is associated with pharyngeal constriction, just above the constriction made for /ʕ/ (Herzallah 1990:64). But rather than positing an unnecessary [pharyngeal] place feature (as in McCarthy 1991), we characterize /a/ with only V-manner[open]. It follows that in /a/-contexts, /ħ, ʕ/ spread their own V-manner[open] to the preceding or following nucleus to create /a/, and the original place node is delinked. This is illustrated in (6a).

## (6) /a/-contexts: V-manner[open] and C-manner[open] spreading

a. // *mi-ħammil* // → *maħammil*b. // *mi-habbib* // → *mahabbib*

Laryngeal /h/ displays similar behavior even though, being characteristically fricative, it has a single C-manner[open] feature. The spreading in (6b) implies that one manner feature, such as [open], can extend from a C-place to a V-place node. I propose that cross-category effects of this type are due to the model's ban on vowels to have any featural material attached to their C-manner node (§1.3.1). As a consequence, the C-manner[closed] feature of the glottal stop /ʔ/ must also attach to a V-manner node on the adjacent vowel nucleus. But since CA has no contrastive V-manner[closed], I presume that the feature [open] will be supplied by interpolation to replace [closed], and the resulting segment is /a/. This is only one possibility to account for the peculiarity of /ʔ/ in the class of /a/-coloring consonants, and it will not be considered any further.

To summarize, labialization in Cairene involves creation of a surface segment /u/, composed of (secondary) V-place[lab] (see Watson 2002:47). It is triggered by a featurally identical labio-velar glide /w/ of a contiguous syllable edge. Environments that condition a low vowel /a/ involve spreading an [open] feature from a C- or a V-manner node.

## 4.2.3 Constraints and Labialization in CA

The current section provides a formal analysis of /u/- and /a/-contexts in Optimality Theory. Let us start with progressive labialization, a process in which triggers are limited to word-initial position. R-ALIGN V-[lab]<sub>//i//</sub> (7a), which ensures that V-place[lab] is lined up with an //i// nucleus vowel, is shorthand for a group of constraints that conjointly have the same effect. This assimilation-driving constraint is in conflict with two faithfulness constraints: DEPLINK V-[lab] in (7b), against new associations of V-place[lab], and MAX V-[cor] in (7c), against the deletion of an underlying //i//. Lastly, the highly-ranked cover constraint PHONOTACTICS guards syllable structure requirements—i.e., against onsetless syllables, complex onsets, etc.

- (7) a. R-ALIGN V-[lab]<sub>//i//</sub>: Given a string CV where C is in word-initial position, if V is composed of a single V-place[cor], then the right edge of V-place[lab] must be aligned to the right edge of the string.
- b. DEPLINK V-[lab]: Do not associate V-place[lab] to a segment that did not have it underlyingly.
- c. MAX V-[cor]: Every V-place[cor] in the input has a correspondent V-place[cor] in the output.

Tableau (8) shows that rightward spreading of V-place[lab] is motivated by ranking R-ALIGN V-[lab]<sub>//i//</sub> above FAITHFULNESS. Candidate (8a) avoids alignment violations by way of deleting the target vowel, and so it is eliminated by PHONOTACTICS. (8b) simply fails to comply with ALIGNMENT. And while all assimilating candidates (with an output /u/ nucleus) must violate MAX V-[cor], the candidate with the fewest violations of DEPLINK V-[lab], viz., (8c), turns out as optimal.

(8) PHONOTACTICS, R-ALIGN V-[lab]<sub>//i//</sub> >> MAX V-[cor], DEPLINK V-[lab]

	//wila:da//	PHONO-TACTICS	R-ALIGN V-[lab] <sub>//i//</sub>	MAX V-[cor]	DEPLINK V-[lab]
a.		*!		*	
b.			*!		
c.				*	*
d.				*	**!

To motivate regressive labialization, we need the shorthand alignment constraint L-ALIGN V-[lab]<sub>//i//</sub> in (9), which ensures that a V-place[lab] feature is attached to a potential target vowel to the left of the trigger in the prosodic word domain.

- (9) L-ALIGN V-[lab]<sub>//i//</sub>: Given a string VC, if V is composed of a single V-place[cor], then the left edge of V-place[lab] must be aligned to the left edge of the string.

In Tableau (10), candidate (b) is rejected because it violates the high ranked L-ALIGN V-[lab]<sub>//i//</sub>. A potential candidate that syncopates the target vowel (10a) is ruled out by PHONOTACTICS, and one that spreads V-place[lab] to the right (d) does not win due to the extra DEPLINK V-[lab] violations. (10c) emerges as the winner.

4. LABIALIZATION

(10) PHONOTACTICS, L-ALIGN V-[lab]<sub>//i//</sub> >> MAX V-[cor], DEPLINK V-[lab]

	//tiwak//	PHONO-TACTICS	L-ALIGN V-[lab] <sub>//i//</sub>	MAX V-[cor]	DEPLINK V-[lab]
a.		*!		*	
b.			*!		
c.				*	*
d.				*	**!

The fact that a long vowel //i// fails to undergo labialization justifies the faithfulness constraint in (11a) against loss of V-place[cor] of an underlyingly bimoraic vowel. Together with PHONOTACTICS, this constraint must outrank ALIGNMENT in order to reject assimilation of underlying //i//. The ranking is given in (11b).

(11) a. MAX V-[cor]<sub>μμ</sub>: Assign one violation mark to any underlyingly bimoraic V-place[cor] segment that has no correspondent V-place[cor] in the output.

b. PHONOTACTICS, MAX V-[cor]<sub>μμ</sub> >> R-ALIGN V-[lab]<sub>//i//</sub>, L-ALIGN V-[lab]<sub>//i//</sub> >> MAX V-[cor], DEPLINK V-[lab]

The ranking needed to derive a prefixal /u/ is identical to (10). But to ensure a surface vowel /i/ in such prefixes when no assimilation takes place, assuming Richness of the Base, we need to employ the basic feature markedness constraints \*V-place[lab], \*V-place[cor], and \*V-manner[open]. Tableau (12) shows that ranking \*V-[cor] below the other two constraints guarantees an output prefix *mi-* regardless of the underlying vowel. The constraints L-ALIGN V-[lab]<sub>//i//</sub> and DEPLINK V-[lab] are not included in the tableau because they are irrelevant for this particular input.

(12) PHONOTACTICS >> \*V-[lab], \*V-[open] >> \*V-[cor]

	//m{v/Ø}-tannaħ//	PHONO-TACTICS	*V-[lab]	*V-[open]	*V-[cor]
a.	mitannaħ				*
b.	mutannaħ		*!		
c.	matannaħ			*!	
d.	mtannaħ	*!			

One way to account for the appearance of /a/ in this complementary distribution is the alignment constraint in (13a). Since this assimilation applies only to a particular //i// final prefix, the constraint must specify the target. ALIGNMENT is in conflict with DEP LINK [open] in (13b), which penalizes new associations of C-manner[open] and/or V-manner[open] features. (I silently disregard the complications related to non-triggers with C-manner[open]).

- (13) a. L-ALIGN [open]<sub>pref//i//</sub>: Given a string VC where V is the final vowel of the participle prefix *mi-*, if V is composed of a single V-place[cor], then the left edge of a feature [open] must be aligned to the left edge of the string.
- b. DEPLINK [open]: Do not associate a feature [open] to a segment that did not have it underlyingly.

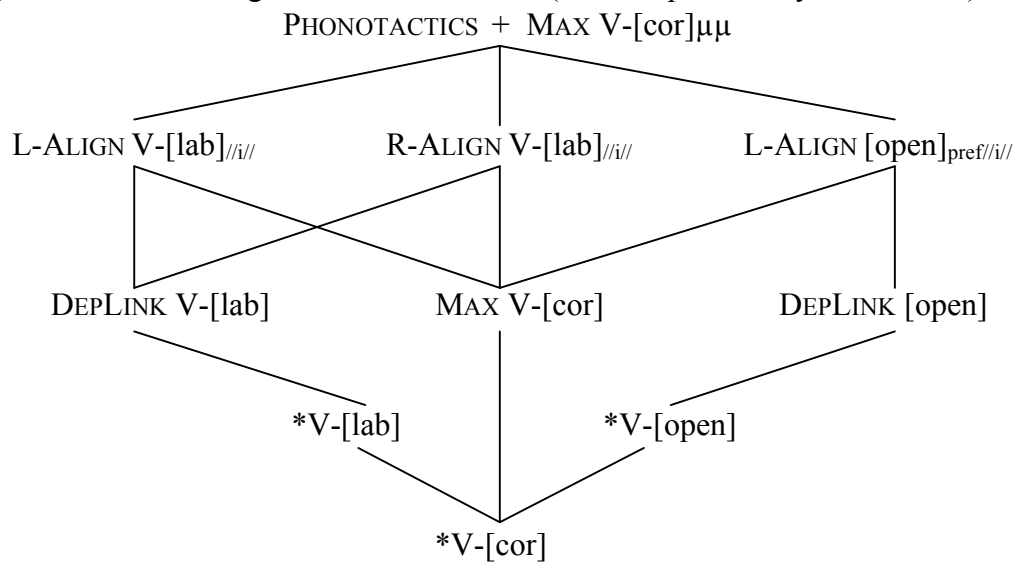
Tableau (14) shows how /a/-contexts are obtained via a similar spreading mechanism. Failure to respect L-ALIGN [open]<sub>pref//i//</sub> is fatal, and results in the elimination of (14b) and (14d). The latter candidate surfaces with /u/ in the prefix, and thus incurs an extra violation of DEPLINK V-[lab]. Due to the lack of an appropriate /u/-trigger, L-ALIGN V-[lab]<sub>//i//</sub> is vacuously satisfied. Only output (c) aligns the V-manner[open] feature of /h/ to the prefixal vowel, and it emerges as optimal.

- (14) PHONOTACTICS >> L-ALIGN [open]<sub>pref//i//</sub>, L-ALIGN V-[lab]<sub>//i//</sub> >> MAX V-[cor], DEPLINK [open], DEPLINK V-[lab]

	//mi-ħammil//	PHONOTACTICS	L-ALIGN V-[lab] <sub>//i//</sub>	L-ALIGN [open] <sub>pref//i//</sub>	MAX V-[cor]	DEPLINK [open]	DEPLINK V-[lab]
a.		*!			*		
b.			*!				
c.					*	*	
d.				*!	*		*

The overall ranking can be outlined as follows. PHONOTACTICS and MAX V-[cor] $\mu\mu$  dominate ALIGNMENT; the latter outranks some faithfulness constraints, which in turn dominate general feature markedness constraints. This is schematized in (15).

(15) Constraint rankings for CA labialization (and complementary distribution)





### 4.3 Labialization in Baghdadi Arabic

Baghdadi Arabic exhibits an interesting labialization effect whereby the short high vowels /i/ and /u/ exist in complementary distribution within certain morphological categories. The appearance of /u/ in these categories is conditioned by a well-defined phonological environment, and there is evidence that /u/ is featurally related to labial, velar, and emphatic consonants (Blanc 1964, Altoma 1969, Bellem 2007; see also Haddad 1984 for Lebanese Arabic and Herzallah 1990 for Palestinian Arabic).

Despite this complementary distribution, the phonemic status of short /i/ and /u/ is well established in BA. They exhibit some contrasts word-internally, e.g., *ǧimal* ‘camel’ vs. *ǧumal* ‘sentences’, and sometimes exist in free variation, e.g., *sudus* ~ *sidis* ‘one sixth’ (Erwin 1963:37). When final in a word, /i/ and /u/ are independent of each other and occur frequently in contrast (no complementary distribution or free variation observed), e.g., *fu:fi* ‘look! FS’ vs. *fu:fu* ‘look! PL’ (ibid., p.39). In a large number of patterns, however, the contrast between non-final /i/ and /u/ is neutralized. This applies to unspecified epenthetic vowels and to certain stem and prefix vowels specified as //i//. Below I argue that the appearance of /u/ is triggered by spreading a labial feature in addition to an emphatic-like or velar-like feature from adjacent consonants, thus showing that /u/ is a contextual variant of /i/ in these classes.

The discussion is organized as follows. Section 4.3.1 examines the distribution of /i/ and /u/ as epenthetic vowels in the CaCvC pattern. Section 4.3.2 examines similar behavior in the initial stem vowel of measure I perfect and imperfect verbs (and some prefixes). Section 4.3.3 sketches an autosegmental analysis of labialization based on the featural makeup of participating segments. Lastly, section 4.3.4 proposes an OT analysis of the process.

#### 4.3.1 Complementary Distribution in the Epenthetic Vowels

The synchronic complementary distribution of /i/~u/ is best seen in the behavior of epenthetic vowels (EV). Like many Arabic dialects, BA has a tendency to break up a final consonant cluster (Ghalib 1984:19).<sup>2</sup> Vowel epenthesis is motivated by syllable structure requirements against words ending in two-consonant sequences with non-identical elements, which are repaired by epenthesizing a vowel to yield CvC. This is coupled with a general principle of structure preservation—that is, the prohibition against deleting any of the radicals of the root (Majdi 1988:197).

This section concentrates on the morphological pattern CaCC (wherein the stem vowel is always /a/). Lexical items in this category are largely composed of nominals, both generic and common nouns, in addition to a limited number of adjectives and adverbs—which all surface as CaCvC via epenthesis (16a). That these classes have an

<sup>2</sup> Final clusters are allowed in very few words, mostly foreign and classical borrowings in addition to some proper names (Altoma 1969:19). All clusters are composed of a sonorant or semi-vowel followed by an obstruent, e.g., *barq* ‘lightening’, *ʔarb* ‘west’, *ʔaṛṛ* ‘land’, *kart* ‘card’, *sfaṅǧ* ‘sponge’, *ʔaṅs* ‘chance’, *hind* ‘Indian’, *baǧǧ* ‘bank’, *ǧajf* ‘army’, *maǧs* ‘May’, *ǧahl* ‘ignorance’, *baṯ* ‘resurrection (a party’s name)’ (Blanc 1964:55, Shamdin Agha 1969:78, see also Abu-Salim 1982:203 ff.).

underlying representation (CaCC) similar to the Old Arabic surface forms is not a supposition. Rather, the word-final clusters have a synchronic status in environments where the EV falls out and the consonants are again in contact. This occurs in sandhi when a subsequent word begins with a vowel—or with two consonants, and hence preceded by an EV—and also when vowel-initial suffixes are added. A few examples are given in (16b). The EV is retained only if a single consonant follows, whether in a suffix or a separate word.

## (16) Vowel epenthesis in the CVCC pattern

a.  $\emptyset \rightarrow V / C \_ \_ C ] N, ADJ$ 

b.	<i>xaliq</i>	‘creation’	→	<i>xalq is-sima</i>	‘the creation of the heaven’
	<i>tʿabuʿ</i>	‘printing’	→	<i>tʿabʿ i kta:b</i>	‘the printing of a book’
	<i>laḥam</i>	‘meat’	→	<i>laḥm i ʿḡma:l</i>	‘camel meat’
	<i>ʃahim</i>	‘noble MS’	→	<i>ʃahm-i:n</i>	‘noble MPL’
	<i>ʕaḏʕum</i>	‘bones’	→	<i>ʕaḏʕm-ak</i>	‘your MS bones’

The interesting fact about this pattern is that the EV may be /a/, /i/, or /u/ depending on the consonantal environment (Altoma 1969:27). The details of this complementary distribution are as follows.

## 4.3.1.1 /u/-coloring environments

If the cluster consists of a labial /p, b, f, m/ followed or preceded by a velar /g, x, ɣ/, uvular /q/, liquid /r/, or emphatic /tʿ, sʿ, ḏʿ, ʕʿ/ (collectively, *back consonants*), the EV is always /u/ as exemplified in (17a–b) (Blanc 1964:56). This is exceptionless for the nominals, although some of these combinations are not found in Baghdadi.<sup>3</sup> The same generalization is noted where the cluster consists of a labial and some other consonant provided the initial consonant is an emphatic (17c). In fact, many of the words that undergo labialization have two emphatics, two velars, or an emphatic and a velar among their consonantal radicals. Thus it is not always possible to verify which of these triggers the process together with the labial consonant.

## (17) /u/-domains

a.	<i>nafux</i>	‘inflating’		<i>dabuy</i>	‘tanning’
	<i>ḥamuq</i>	‘furiousness’		<i>waquf</i>	‘religious endowment’
	<i>sagum</i>	‘boredom’		<i>saguf</i>	‘ceiling’
	<i>xafuq</i>	‘throbbing’		<i>ḥarub</i>	‘war’
	<i>ʔamur</i>	‘order’		<i>ḥafur</i>	‘digging’

<sup>3</sup> Among nominals, there are no counterexamples with epenthetic /i/ in /u/-domains. However, I found three such adjectives—namely, *ḡasʕib* ‘fertile MS’, *ḏʕaxim* ‘huge MS’, and *sʕalib* ‘rigid MS’, the last of which contrasts with the nominal *sʕalub* ‘crucifixion’.

b.	<i>ʃatʔuf</i>	‘compassion’	<i>ʃatʔub</i>	‘crossing’
	<i>ħaβutʔ</i>	‘dropping’	<i>sʔafutʔ</i>	‘stacking’
	<i>tʔamʊsʔ</i>	‘bogging down’	<i>raʔfusʔ</i>	‘kick’
	<i>βasʔum</i>	‘stamping’	<i>ʃaδʔum</i>	‘bone’
	<i>naβuδʔ</i>	‘pulse’	<i>qabʊδʔ</i>	‘getting paid’
c.	<i>tʔabʊʃ</i>	‘printing’	<i>tʔabʊl</i>	‘drumming’
	<i>tʔaʃʊm</i>	‘taste’	<i>tʔafuħ</i>	‘overflowing’
	<i>sʔaʃʊβ</i>	‘difficult’	<i>sʔafʊn</i>	‘meditating’
	<i>sʔafuħ</i>	‘sideways’	<i>δʔabʊʃ</i>	‘hyena’

Some nominals surface with EV /u/ when a labial /p, b, f, m/ or a back non-emphatic /g, x, ɣ, q, r/ is in C<sub>1</sub> position (non-adjacent to the target vowel), as shown in (18a–b). Since these nominals are derived from a verbal base, one possibility is that they show a paradigm uniformity effect with their correspondent verbal forms in which the first stem vowel is flanked between a labial and a back non-emphatic trigger (see (23a) in §4.3.2). Finally, there are a few exceptional cases of epenthetic /u/ where the radicals include one or more back triggers but no labials. All cases found are listed in (18c).

(18) Exceptions to /u/-domains: over-application

a.	<i>xamuʃ</i>	‘snatching’	<i>xabuz</i>	‘baking’
	<i>yamuz</i>	‘winking’	<i>yaful</i>	‘neglecting’
	<i>qaful</i>	‘closing’	<i>kafuz</i>	‘mounting’
	<i>gafuʃ</i>	‘peeling’	<i>gamuz</i>	‘jumping’
	<i>rafuʔ</i>	‘lifting’	<i>raham</i>	‘fitting’
b.	<i>βaʃʊsʔ</i>	‘giving the finger’	<i>βasʔutʔ</i>	‘beating’
	<i>βatʔuħ</i>	‘throwing down’	<i>βaʃʊδʔ</i>	‘loathing’
	<i>faʔuδʔ</i>	‘imposing’	<i>faʔuʃ</i>	‘becoming empty’
	<i>faʔutʔ</i>	‘loose’	<i>paʔutʔ</i>	‘disclosing inadvertently’
c.	<i>naʔʊsʔ</i>	‘deficiency’	<i>raʔʊsʔ</i>	‘dancing’
	<i>sʔaʔʊr</i>	‘falcon’	<i>laʔʊtʔ</i>	‘picking’
	<i>ʃaxur</i>	‘snoring’	<i>ʃaxʊtʔ</i>	‘scratching’
	<i>ħalʔutʔ</i>	‘mixing’	<i>raʔʊδʔ</i>	‘running’
	<i>ʃaʔʊtʔ</i>	‘condition’	<i>ʃaħʊtʔ</i>	‘scraping’

As in CA (§4.2.1), the presence of an adjacent /w/ after a vowel in BA is sufficient to trigger regressive rounding in various patterns, while /w/ before a vowel results in variation between /u/ and /i/ (19a). In a CaCC pattern, a medial radical /w/ (in hollow roots) triggers no epenthesis, and monophthongization takes place (§5.3.2.2). A final radical /w/ (in defective roots) need not trigger epenthesis because the radical /w/ will surface as a nucleus /u/, as exemplified in (19b). An initial radical /w/, on the other hand, does trigger labialization in measure I perfect verbs (see §4.3.2).

## (19) /w/ as a trigger of regressive and progressive labialization

a.	<i>kuwam</i>	‘piles’	<i>fuwat</i> <sup>f</sup>	‘headscarves’
	<i>suwa</i>	‘together’	<i>duwa</i>	‘remedy’
	<i>ðuwa</i>	‘light’	<i>wulid ~ wilid</i>	‘children’
b.	<i>naħu</i>	‘grammar’	<i>lahu</i>	‘amusement’
	<i>raxu</i>	‘soft’	<i>dalū</i>	‘bucket’
	<i>ʕafu</i>	‘forgiveness’	<i>sʕafu</i>	‘purity’

These generalizations suggest that surface /u/ is composed of both labial and “back” features, a claim supported by independent evidence. While BA allows the sequence labial+/w/ if they are part of different syllables, the labio-velar glide /w/ is deleted in the second position of a complex onset; compare the two columns in (20). The output is a geminate labial onset that is articulated with emphasis (Blanc 1964:18–9). This indicates that the feature content of /w/ incorporates some emphatic feature (see also Abumdas 1985:140 with reference to Libyan Arabic).

## (20) Labial emphatics from labial velars

<i>waħdak</i>	‘yourself’	<i>bbaħdak</i> /* <i>bwaħdak</i>	‘by yourself’
<i>libwa:bi:ɕ</i>	‘the slippers’	<i>bba:bi:ɕ</i> /* <i>bwa:bi:ɕ</i>	‘slippers’
<i>lifwa:d</i>	‘the heart’	<i>ffa:d</i> / * <i>fwa:d</i>	‘heart, entrails’
<i>lifwa:nis</i>	‘the lamps’	<i>ffa:nis</i> / * <i>fwa:nis</i>	‘lamps’ (rare)
<i>but</i> <i>likwabi:s</i>	‘the nightmares’	<i>kwabi:s</i>	‘nightmares’

## 4.3.1.2 /i/-coloring environments

Excluding /u/-domains, the EV is mostly /i/. Note that the EV is /i/ if only one of the cluster consonants is a labial or a back consonant (21a), or if the cluster consists of two back consonants (21b) (exceptions in (18) above). Here, two comments are in order concerning the class of back consonants. First, examples like *ramiz* and *raʔif* show that an initial /r/ and a C<sub>2</sub>/C<sub>3</sub> labial do not trigger labialization. This confirms the characterization of /r/ as a non-emphatic in BA (§3.3.2.1), or else it would behave like the emphatics in (17c). Second, *lakim* and *rabik* indicate that /k/ does not behave like other velars in this particular context (see the comment in §4.3.3). That is to say, a cluster consisting of /k/ and a labial results in epenthetic /i/, rather than /u/ (Bellem 2007:278).

## (21) /i/-domains

a.	<i>ramiz</i>	‘symbol’	<i>dafiʕ</i>	‘payment’
	<i>lakim</i>	‘punching’	<i>rabik</i>	‘confusion’
	<i>daʔib</i>	‘habit’	<i>ʕaɖib</i>	‘fresh MS’
	<i>ʔaxið</i>	‘taking’	<i>nahig</i>	‘braying’
	<i>baʔin</i>	‘belly’	<i>faðʕilʕ</i>	‘favor’
	<i>ɕalʕitʕ</i>	‘goofing’	<i>ɕarʕisʕ</i>	‘pinching’

b.	<i>lat̤iḫ</i>	‘stain’	<i>maṣ̤iḫ</i>	‘scolding’
	<i>ʃax̤is̤</i>	‘person’	<i>ḏ̤aḫ̤it̤</i>	‘pressure’
	<i>naḡiḏ̤</i>	‘exhaustion’	<i>waṣ̤it̤</i>	‘middle’
	<i>maḫ̤it̤</i>	‘blowing the nose’	<i>maḫ̤it̤</i>	‘wrestling’

## 4.3.1.3 /a/-coloring environments

An important observation is that the EV may surface as /a/ if the first consonant of the cluster is /ħ, ʕ, h, x, ʁ/. This has led some researchers (e.g., Blanc 1964:55, Altoma 1969:29) to identify separate /a/-domains. However, the occurrences of epenthetic /a/ are for the most part restricted to a subclass of the CaCC pattern—namely nonderived nominals, adjectives, and adverbs (22a). In case of generic nominals (derived from a verbal base), the epenthetic vowel is /i/ even if one of the consonants /ħ, ʕ, h, x, ʁ/ is part of the cluster, as shown in (22b). The pairs in (22c) show some striking /a~/i/ contrasts between nonderived and derived nominals. Note that in some combinations of these consonants with labials, only nonderived nominals are ever found.

## (22) /a/-domains

a.	<i>ʃahar</i>	‘month’	<i>naħal</i>	‘bees’
	<i>faħal</i>	‘male’	<i>taħat</i>	‘under’
	<i>baʕad</i>	‘after’	<i>kaʕak</i>	‘cakes’
	<i>baxat</i>	‘luck’	<i>s̤aḫar</i>	‘rock’
	<i>baḡal̤</i>	‘mule’	<i>naḡal̤</i>	‘bastard’
b.	<i>zahif</i>	‘erring’	<i>nahib</i>	‘plundering’
	<i>saħib</i>	‘pulling’	<i>ʃaħin</i>	‘shipping’
	<i>daʕis</i>	‘knocking down’	<i>t̤aʕin</i>	‘stabbing’
	<i>baḏix</i>	‘lavish spending’	<i>ladiy</i>	‘stinging’
c.	<i>laħam</i>	‘meat’	<i>lahim</i>	‘mending’
	<i>ʃahar</i>	‘month’	<i>ʃahir</i>	‘making famous’
	<i>mahar</i>	‘dowry’	<i>mahir</i>	‘stamping’
	<i>sahal</i>	‘lowland’	<i>sahil</i>	‘easy’

## 4.3.2 Complementary Distribution in Verbs and Verbal Derivatives

When morphological considerations lead to a choice between /i/ and /u/, the quality is often predetermined by the aforementioned contextual factors. The /i~/u/ complementary distribution in BA can be observed in the perfect and imperfect of measure I verbs and their derivatives, among various other morphological classes.

Unlike most other Arabic dialects (e.g., CA) which kept a two-way contrast in measure I perfect verbs between CaCaC and CiCiC, the *gilit*-dialects of Mesopotamia (e.g., BA) have a single pattern CiCaC, which alternates with CuCaC in well-defined contexts (Blanc 1964:98). Indeed, most of these verbs are counterparts of the CVCC nominals above, but instead of the epenthetic V<sub>2</sub> it is the first stem vowel (SV<sub>1</sub>) that

alternates between /i/ and /u/ (Altoma 1969:54).<sup>4</sup> Rounding of SV<sub>1</sub> applies whenever the first two radicals, in either order, are a labial and a back consonant (Bellem 2007: 233) (23a–b). And with a few exceptions, velar /k/ behaves like the back consonants here. A SV<sub>1</sub> /u/ also obtains if C<sub>1</sub>/C<sub>2</sub> is labial and the final consonant is emphatic, e.g., *ḥuḇaṭʿ* ‘he dropped’ and *ḥuḇaṭʿ* ‘it became sour’. Furthermore, /u/ obtains where the second /a/ is final, e.g., *muḏʿa* ‘he signed’, *buqa* ‘he stayed’, and *yufa* ‘he dozed off’ (Blanc 1964:40). And finally, Blanc indicates some variation in the application of the process whenever triggered by a labio-velar /w/ in the onset, as shown in (23c).

## (23) /u/ as a stem vowel in CVCaC verbs

a.	<i>furak</i>	‘he rubbed’	<i>furay</i>	‘it became empty’
	<i>fuqad</i>	‘he lost’	<i>futʿar</i>	‘he broke his fast’
	<i>ḥuṣʿatʿ</i>	‘he beat’	<i>ḥutʿal</i>	‘it became invalid’
	<i>muṣʿax</i>	‘he scolded’	<i>murad</i>	‘he squashed’
b.	<i>ruḇaṭʿ</i>	‘he fastened’	<i>ruḇasʿ</i>	‘he kicked’
	<i>sʿuḇar</i>	‘he was patient’	<i>ḏʿufar</i>	‘he won’
	<i>tʿuḇaḡ</i>	‘he juxtaposed’	<i>tʿufar</i>	‘he jumped’
	<i>qufal</i>	‘he closed’	<i>qubadʿ</i>	‘he got paid’
	<i>xubaz</i>	‘he baked’	<i>gumaz</i>	‘he jumped’
	<i>yumaz</i>	‘he winked’	<i>yufal</i>	‘he neglected’
	<i>kumaf</i>	‘he seized’	<i>kufaz</i>	‘he mounted’
	<i>kufar</i>	‘he disbelieved’	<i>kubar</i>	‘he grew up’
c.	<i>wuṣʿal</i>	~	<i>wiṣʿal</i>	‘he arrived’
	<i>wuṣʿaf</i>	~	<i>wiṣʿaf</i>	‘he described’
	<i>wuḡaf</i>	~	<i>wiḡaf</i>	‘he stopped’
	<i>wuzan</i>	~	<i>wizan</i>	‘he weighed’
	<i>wuṣʿad</i>	~	<i>wiṣʿad</i>	‘he promised’

The complementary distribution persists in the perfect verb apart from a few lexical exceptions where /u/ surfaces unexpectedly. In *nufax* ‘he inflated’ and in *ḏʿurab* ‘he struck’, the final velar or labial consonants are non-adjacent to the target stem vowel, but both verbs are reported to exist in free variation with *nifax* and *ḏʿirab* (Woodhead and Beene 1967).

Excluding the /u/-coloring environments, the first stem vowel is always /i/ (24a), even if C<sub>1</sub>/C<sub>2</sub> is back but no labial among the radicals (24b) or if C<sub>1</sub>/C<sub>2</sub> is labial but no back consonant among the radicals (24c). A small number of exceptions occur where one expects SV<sub>1</sub> /u/. Usually the flanking consonants in these are composed of /k/ and a labial, e.g., *kibas* ‘he packed’, *kifal* ‘he vouched for’, and *kimal* ‘it was finished’.

<sup>4</sup> Only the two *hamza*-initial verbs *?akal* ‘he ate’ and *?axaḏ* ‘he took’ retain one of the three OA patterns in measure I perfect verbs: CaCaC, CaCiC, and CaCuC (Altoma 1969:54, Odden 1978:145).

(24) /i/ as a stem vowel in CVCaC verbs: elsewhere

a.	<i>liʕab</i>	‘he played’	<i>ħisab</i>	‘he reckoned’
	<i>lizam</i>	‘he held’	<i>kitab</i>	‘he wrote’
	<i>kisar</i>	‘he broke’	<i>kital</i>	‘he killed’
	<i>riḵaḏ<sup>ʕ</sup></i>	‘he ran’	<i>ʕiʕal</i>	‘he lit’
b.	<i>ḏiḵar</i>	‘he mentioned’	<i>ḏiḵak</i>	‘he laughed’
	<i>giʕad</i>	‘he sat’	<i>ġiʕaʕ</i>	‘he cut’
	<i>ġiḏʕa</i>	‘he spent (time)’	<i>yiʕal</i>	‘he washed’
	<i>ʕiqad</i>	‘he tied’	<i>ʕiʕar</i>	‘he squeezed’
c.	<i>libas</i>	‘he dressed’	<i>simaʕ</i>	‘he heard’
	<i>tifal</i>	‘he spit’	<i>difaʕ</i>	‘he pushed’
	<i>bina</i>	‘he built’	<i>minaʕ</i>	‘he prevented’

If the initial stem vowel is adjacent to a back consonant and C<sub>3</sub> is a labial, it will surface as /i/ (25). However, when SV<sub>2</sub> is dropped in these verbs before the third person feminine singular and plural suffixes *-at* and *-aw*, SV<sub>1</sub> will surface as /u/ (Erwin 1963:90) even though the labial is not strictly adjacent to the target vowel. Upon addition of such -V(C) pronominal suffixes to other verb types, the pre-final SV /a/ is usually zeroed out with no effect on the initial SV, e.g., *mṭr-at* ‘it rained’, *qubḏ<sup>ʕ</sup>-aw* ‘they grasped’, *sibḥ-aw* ‘they swam’, and *giʕd-at* ‘she sat’ (Blanc 1964:40).

(25) Alternating /i/ and /u/ environments in the same verb form

<i>ʕiraf</i>	‘he knew’	<i>ʕurf-at</i>	‘she knew’
<i>sʕiraʕ</i>	‘he spent’	<i>sʕurf-aw</i>	‘they spent’
<i>xirab</i>	‘it broke down’	<i>xurb-at</i>	‘she broke down’
<i>ʕirab</i>	‘he drank’	<i>ʕurb-aw</i>	‘they drank’
<i>yiḏʕab</i>	‘he got angry’	<i>yiḏʕb-at</i>	‘she got angry’
<i>xiṭʕab</i>	‘he made a speech’	<i>xiṭʕb-aw</i>	‘they made a speech’
<i>tʕiʕab</i>	‘he asked for’	<i>tʕiʕb-at</i>	‘she asked for’
<i>xiʕam</i>	‘he took off (price)’	<i>xiʕm-aw</i>	‘they took off (price)’

The imperfect of measure I verbs has the pattern -CCVC where V is /a/, /i/, or /u/, but the realization of V is completely predictable from the nature of the radicals involved (see Erwin 1963:110).<sup>5</sup> While the imperfect patterns -CCiC and -CCuC are shifted from perfect CiCaC and CuCaC, respectively, the imperfect pattern -CCaC is shifted from perfect CiCaC or CuCaC. And it is not possible to predict whether a CiCaC/CuCaC perfect pattern corresponds to -CCaC or to -CCiC/-CCuC in the imperfect. Nonetheless, one can maintain that the vast majority of imperfect -CCuC patterns have an /u/-domain.

<sup>5</sup> An apparently similar distribution in the imperfect of measure I verbs occurs in Cairene (see Abboud 1976). However, a substantial number of exceptions indicate that it must be lexicalized/historical.

Subject inflections are expressed on imperfect verbs as CV- prefixes (compared to a suffix in the perfect verbs). Except for the first person singular prefix *ʔa-*, the prefix-final vowel is underlyingly //i//, and it may surface as /i/ or /u/. Four patterns are observed in Baghdadi imperfect measure I verbs: *ji-CCaC*, *ji-CCiC*, *ji-CCuC*, and *ju-CCuC* (Altoma 1969:55). The first two imperfect patterns (-CCaC and -CCiC) will surface as CiCaC in the perfect, as exemplified in (26a–b) respectively, and the prefix vowel is always /i/ in these classes (Erwin 1963:110–2).

## (26) /i/ or /a/ as the imperfect stem vowel of CiCaC perfect verbs

a.	<i>ji-lbas</i>	‘he wears’	<i>ji-dfaʕ</i>	‘he pays’
	<i>ti-rʕaʕ</i>	‘she comes back’	<i>ti-ħlam</i>	‘she dreams’
	<i>ti-sbaħ</i>	‘you MS swim’	<i>ti-smaʕ</i>	‘you MS hear’
	<i>ni-smaħ</i>	‘we get fat’	<i>ni-tʔaʕ</i>	‘we go out’
b.	<i>ji-ktib</i>	‘he writes’	<i>ji-ʕlif</i>	‘he scours’
	<i>ti-ħriġ</i>	‘you MS burn’	<i>ti-zʕiġ</i>	‘you MS annoy’
	<i>ti-sʕdim</i>	‘she bumps into’	<i>ti-ysil</i>	‘she washes’
	<i>ni-ʕzim</i>	‘we invite’	<i>ni-ʕzib</i>	‘we please’

The prefix vowel is also /i/ in a class of -CCaC imperfect verbs that surface as either CuCaC or CiCaC in the perfect. The perfect CiCaC subclass comprises only verbs where  $SV_1$  is adjacent to a back consonant and  $C_3$  is a labial, such as those in (25). A prefix vowel /i/ is expected given that these verbs do not surface with a SV /u/ in the imperfect. However, when the SV /a/ is dropped in these verbs before the feminine suffix *-in* (second person) and the plural suffix *-u:n* (second and third person), this creates an /u/-domain for the epenthetic vowel that is inserted between  $C_1$  and  $C_2$ . Again, this takes place even though the labial in  $C_3$  position is not adjacent to the unspecified target vowel. And not only do we get an /u/ EV, but the prefixes *j(u)-* and *t(u)-* also surface with /u/ via vowel harmony. This is demonstrated in (27).

## (27) /a/ as the imperfect stem vowel of CiCaC/CuCaC perfect verbs

<i>Perfect</i>	<i>Imperfect 3 MS</i>	<i>Imperfect 2/3 PL</i>	<i>gloss</i>
<i>xirab</i>	<i>ji-xrab</i>	<i>ju-xurb-u:n</i>	‘to collapse’
<i>girab</i>	<i>ji-grab</i>	<i>ju-gurb-u:n</i>	‘to approach’
<i>yiðʕab</i>	<i>ji-ʕðʕab</i>	<i>ju-ʕuðʕb-u:n</i>	‘to get angry’
<i>kubar</i>	<i>ji-kbar</i>	<i>tu-kubr-u:n</i>	‘to grow up’
<i>rubah</i>	<i>ji-rbah</i>	<i>tu-rubħ-u:n</i>	‘to win’

The prefix vowel is /u/ before -CCuC imperfect verbs, where any two of the radical consonants constitute an /u/-domain. These verbs may surface as either CuCaC or CiCaC in the perfect, where the CiCaC verbs have a labial  $C_3$ . However, since there is only one stem vowel (nucleus) in the imperfect base, the adjacency requirement is not at issue. The /u/ stem vowel influences the prefix vowel, which may surface as /u/



through vowel harmony (Blanc 1964:99). This pattern, given in (28a–b), is interesting because it displays labialization and vowel harmony in the same lexical item (Erwin 1963:113).<sup>6</sup> Finally, (28c) displays some exceptional verbs in this group with no labial among the radicals.

(28) /u/ as the imperfect stem vowel of CiCaC/CuCaC perfect verbs

a.	<i>Perfect</i>	<i>burad</i>	‘he cooled off’	<i>ʕiraf</i>	‘he knew’
	3 MS	<i>ju-brud</i>	‘he cools off’	<i>ju-ʕruf</i>	‘he knows’
	FS	<i>tu-brud</i>	‘she cools off’	<i>tu-ʕruf</i>	‘she knows’
	PL	<i>ju-burd-u:n</i>	‘they cool off’	<i>ju-ʕruf-u:n</i>	‘they know’
	2 MS	<i>tu-brud</i>	‘you MS cool off’	<i>tu-ʕruf</i>	‘you MS know’
	FS	<i>tu-burd-i:n</i>	‘you FS cool off’	<i>tu-ʕruf-i:n</i>	‘you FS know’
	PL	<i>tu-burd-u:n</i>	‘you PL cool off’	<i>tu-ʕruf-u:n</i>	‘you PL know’
	1 S	<i>?a-brud</i>	‘I cool off’	<i>?a-ʕruf</i>	‘I know’
	PL	<i>nu-brud</i>	‘we cool off’	<i>nu-ʕruf</i>	‘we know’
b.	<i>ju-ʕʕum</i>	‘he slaps’	<i>ju-xʕum</i>	‘he takes off (price)’	
	<i>ju-bruk</i>	‘it kneels down’	<i>ju-ðʕub</i>	‘he strikes’	
	<i>ju-ʕʕub</i>	‘he beats’	<i>ju-tʕub</i>	‘he asks for’	
	<i>ju-rʕuʕ</i>	‘he ties’	<i>ju-nʕuʕ</i>	‘it pulsates’	
	<i>ju-sʕuf</i>	‘he spends’	<i>ju-mfux</i>	‘he blows’	
	<i>ju-sʕur</i>	‘he whistles’	<i>ju-kfur</i>	‘he disbelieves’	
	<i>ju-tʕus</i>	‘he bogs down’	<i>ju-xbuz</i>	‘he bakes’	
c.	<i>ju-knus</i>	‘he sweeps’	<i>ju-rʕuʕ</i>	‘he runs’	
	<i>ju-dxul</i>	‘he enters’	<i>ju-skut</i>	‘he stops talking’	
	<i>ju-ngur</i>	‘he knocks’	<i>ju-xnug</i>	‘he strangles’	

This kind of distribution is copied across other patterns derived from a verbal base. To give one last example, in measure I active participles (of the pattern Ca:CVC) the consonantal environment may be /u/-coloring or /i/-coloring (McCarthy and Raffouli 1964:50). In the most general case, the final vowel surfaces as /u/ whenever one of the flanking consonants is a labial and the other “back” (Malaika 1963:2), or if C<sub>2</sub> is replaced by /w/, as exemplified in (29a). All other contexts are /i/-coloring (29b). A consequence of this distribution is that no minimal pairs involving plain vs. emphatic Ca:CaC patterns are found since the final /i/ usually gets labialized to /u/ in an emphatic context.

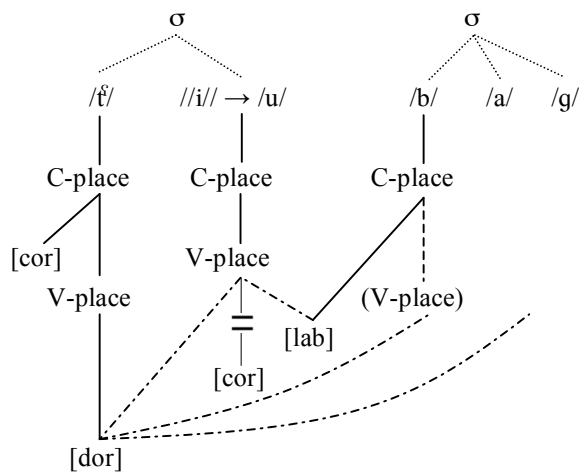
<sup>6</sup> Herzallah’s (1990) characterization of Palestinian Arabic shows that it has a similar distribution. She claims that the appearance of /u/ in the prefix vowel of imperfect measure I verbs is the result of “a vowel harmony process in which it agrees in dorsality with the (/u/) stem vowel” (p.231). While she attributes the appearance of a stem vowel /u/ to “a dorso-pharyngeal class of consonants” (emphatics and velars), she fails to observe the existence of a labial consonant in most of her examples. Parkinson (1992:115) maintains that the persistence of labials in such forms (in Rwaili Arabic) is coincidental.



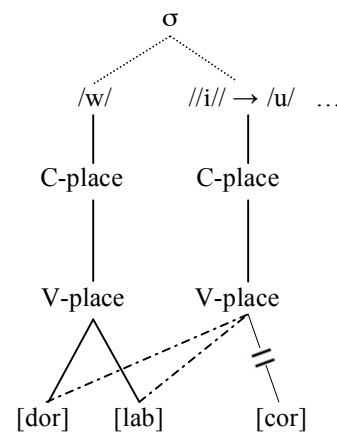
With these premises in mind, the emergence of /u/ as an epenthetic vowel and as SV<sub>1</sub> of measure I perfect verbs can be accounted for. Spreading from a labial and an emphatic is straightforward. On the one hand, the feature [labial] spreads locally from an adjacent labial consonant. If our model dictates that vowels may not attach any feature to their C-place node, then [labial] must attach to a V-place node on the target vowel. The fact that the emphatic consonants /t̤, s̤, ð̤, ʔ̤<sup>9</sup> participate in the process is simply attributed to their underlying V-place[dor] feature that spreads independently (see §3.3.3). The emphatic trigger need not be adjacent to the target vowel since ES targets the stem word domain. (30a) exhibits how the two simultaneous spreading mechanisms result in a surface /u/ with the complex articulation of V-place[lab] and V-place[dor] (upon delinking of V-place[cor]). (30b) illustrates simple local spreading from an onset /w/ to SV<sub>1</sub> of the perfect verb.

(30) Labialization from labial and emphatic consonants and from /w/

a. // t̤ibag // → t̤uḅaḡ



b. // wigaf // → wuḡaf

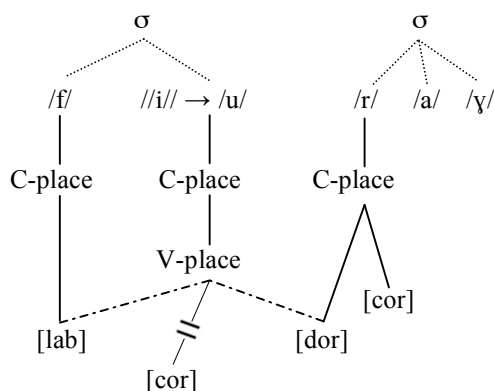
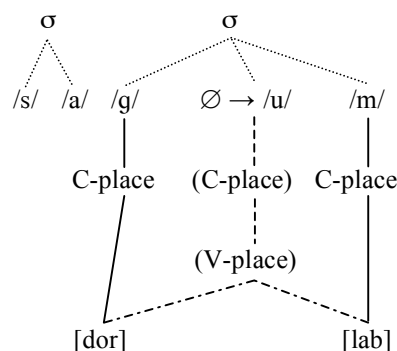


Other back consonants that participate in labialization are velars /k, g, x, ɣ/, uvular /q/, and liquid /r/. These consonants are treated as the natural class of C-place[dor] segments (see §2.3.3.1). Although they cannot be specified for V-place[dor] because they do not trigger ES, their behavior resembles emphatics with regard to creating /u/-contexts (in combination with a labial). Such correspondence provides evidence in support of a representational option where a single feature extends from a C-place to a V-place node (cf. Clements 1991, Hume 1996). This applies to triggers that have C-place[lab] and C-place[dor] in (31a–b). The logic is that any place feature (vocalic or consonantal) spreading to a vowel will attach to a V-place node. The original V-place [cor] feature is delinked in (31a), but not in (31b) because the epenthetic vowel is not specified underlyingly (epenthetic /i/ is supplied later by default fill-in).

<sup>9</sup> Emphatic /ʔ/ is missing from all characterizations of /u/-coloring domains in the literature, despite the abundance of cases shown above.

Two C-place[dor] segments are worth some attention. From an articulatory point of view, the liquid /r/ is not related to velar or uvular consonants. However, BA /r/ has been characterized with “back” articulation (al-Ani 1970:33, Rahim 1980:245). And since it is clearly not emphatic (V-place[dor]), we must entertain the possibility of C-place[dor]. We find that /r/ patterns with /k, g, x, ɣ, q/ in labialization, and there is no other phonological evidence against including /r/ in this class. This confirms that the choice of the label [dorsal] is not phonetically determined, although it is, in some way, phonetically motivated. On the other hand, recall that /k/ does not always pattern with this group (inducing EV /i/), yet it still has C-place[dor]. This occasional association of /k/ with “front” contexts (Bellem 2007:278 ff.) is partially attributed to its historical affrication (see §6.3). Synchronically, I consider this behavior as exceptional, with no direct consequence on the featural composition.

## (31) Labialization from labial and back (non-emphatic) consonants

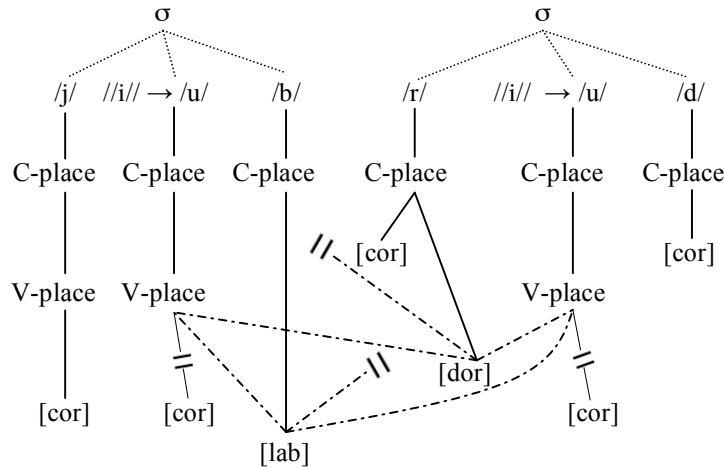
a. // *firay* // → *furay*b. // *sagm* // → *sagum*

What appears like vowel harmony from the imperfect stem vowel to the prefix vowel is slightly more complicated. Although various analyses of vocalic feature spreading across intervening consonants have been proposed in phonological theory (see e.g., Odden 1991, 1994, van der Hulst and van de Weijer 1995, Krämer 2001), segment skipping seems to be incompatible with a Unified Features framework. The reason is that consonants can in principle bear V-place features as their primary or secondary articulation, which makes all intervening consonants potential targets of vowel harmony. It appears that the PSM must adopt the notion of strict locality in spreading (Gafos 1996) by which all segments in a given span are necessarily participants.

I posit that this pattern, as in *ju-brud* ‘he cools off’, is best interpreted as a single spreading mechanism of the features [labial] and [dorsal] from the respective consonant targeting both stem and prefixal vowels of the imperfect. This is clearly more economical than vowel harmony (cf. Padgett 2011). As illustrated in (32), [labial] and [dorsal] extend to the target vowels, spanning all intervening consonants. But these consonants remain unaffected (cf. Bassell 1998). The reason is that an additional C-place[lab] or C-place[dor] accomplishes nothing in the way of contrast, and hence the resulting configurations are rejected by markedness constraints (see Ni Chiosáin and

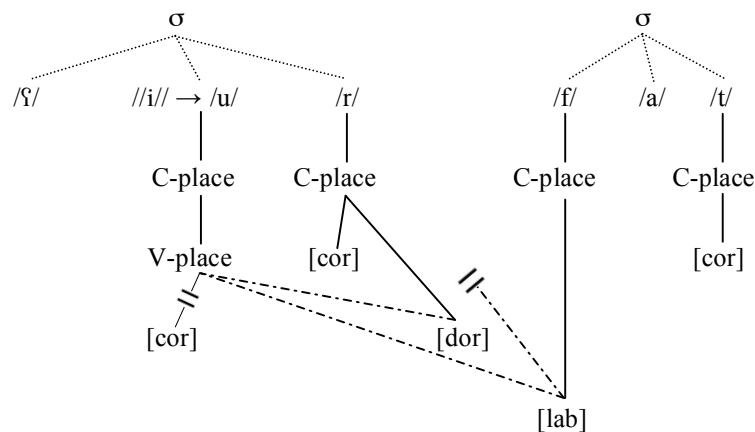
Padgett 2001). (Spreading and concurrent delinking are indicated in the diagram by interrupted dashed lines). The entire spreading machinery results in an apparently harmonious stem and prefix /u/-vowel melody.

(32) Labialization targeting stem and prefix vowels: //ji-brid// → ju-brud



The strict locality account explains the alternating  $SV_1$  of perfect verbs in (25), e.g., *ʕiraf* ‘he knew’ vs. *ʕurf-at* ‘she knew’. In *ʕiraf*, the [labial] feature is not adjacent to the target  $SV_1$  and it may not spread over an intervening vowel (since  $SV_2$  does not alternate). Spreading [dorsal] alone (from /r/) is not sufficient to trigger labialization. But when  $SV_2$  is dropped in *ʕurf-at*, an /u/-domain is created since [lab] may spread to a vowel across intervening consonants. This is illustrated below.

(33) Labialization in verbs with alternating  $SV_1$ : //ʕiraf-at// → ʕurf-at

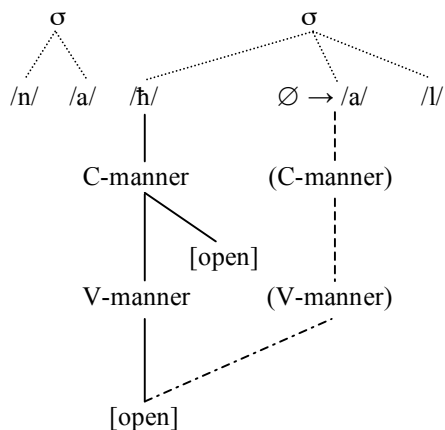


One final remark concerns the connection between the consonants /ħ, ʕ, h, x, ʁ/ and an epenthetic front low vowel /a/. Despite being morphologically restricted to non-derived nominals, the pattern offers reasonable grounds for the feature makeup of these segments. As in CA, we may hypothesize that /a/ has only V-manner[open] and that the pharyngeals /ħ, ʕ/ have C-manner[open] and V-manner[open]. (At least /ʕ/

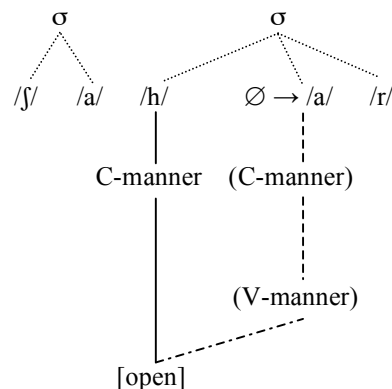
has been articulatorily described as approximant in BA (Butcher and Ahmad 1987)). It follows that /ħ, ʕ/ will spread their own V-manner[open] to the unspecified EV to create /a/ (34a). The other triggers are the fricatives /h, x, ɣ/. They will spread their C-manner[open] feature, which lands on the V-manner node of the EV (34b).

(34) /a/-contexts: V-manner[open] and C-manner[open] spreading

a. // *naħl* // → *naħal*



b. // *fahṛ* // → *fahar*



The autosegmental representations in this section state three important propositions. First, Baghdadi labialization is an instance of a unique gang-up effect in which the quality of a vowel /u/ is determined by *two* neighboring (back and labial) consonants. Second, a place (or manner) feature may spread from a C-node to a V-node in cross-category effects. This is due to a model-specific ban on vowels to have any featural content under their C-node. Third, long-distance assimilation must comply with strict locality. And while no features may spread across intervening consonants without violating the NCC, a feature is not always realized contrastively on these consonants.

#### 4.3.4 Constraints and Labialization in BA

This section gives an optimality-theoretic account of BA labialization. First, let us consider the complementary distribution in epenthetic vowels. In order to enforce epenthesis in word-final clusters, the markedness constraint against coda clusters, \*COMPCODA, must outrank one against vowel insertion (see §2.3.5). Recall that in the absence of assimilation, the EV surfaces with a V-place[cor] feature (as /i/) that it receives by default fill-in; hence, we use the specific faithfulness constraint DEP V-[cor]. And given the crucial ranking \*COMPCODA >> DEP V-[cor], a candidate with EV /i/ fares better than one with a complex coda. Other DEP [F] constraints are highly ranked since epenthetic /u/ and /a/ require specific consonantal triggers.

Following earlier autosegmental representations, an epenthetic /u/ requires two constraints that align the features [lab] and [dor] of a consonant to an EV splitting the final cluster in CaCC nominals and adjectives or to initial stem vowels of perfect and imperfect measure I verbs (and vowels of their inflectional prefixes). It is necessary that the shorthand constraints in (35a–b) refer explicitly to these morphologically

conditioned target vowels since the spreading does not take place in other contexts. I have shown that spreading V-place[dor] is independently motivated via emphasis spread. Hence, an emphatic trigger need not be adjacent to the target vowel. Labial and non-emphatic back triggers, on the other hand, must be contiguous to the target vowel or have some consonant(s) between them. The fact that no vowel may stand between target and trigger is translated into  $X = \emptyset/C$  in the constraint formulation.

- (35) a. ALIGN [lab]-V̇: Given an output sequence CXV̇ or V̇XC (where  $X = \emptyset$  or C and  $V̇ = EV$  in the pattern CaCvC / SV<sub>(1)</sub>) of perfect & imperfect measure I verbs / V of inflectional prefixes), the right/left edge of [lab] must be aligned to the right/left edge of the sequence.
- b. ALIGN [dor]-V̇: Given an output sequence CXV̇ or V̇XC (where  $X = \emptyset$  or C and  $V̇ = EV$  in the pattern CaCvC / SV<sub>(1)</sub>) of perfect & imperfect measure I verbs / V of inflectional prefixes), the right/left edge of [dor] must be aligned to the right/left edge of the sequence.

The association of consonantal [lab] and [dor] to a V-place node on the target vowel obtains automatically from assumptions of the adopted feature theory (cf. Uffmann's 2005 \*LINK(X, Y) constraint against cross-node linkage). Compliance with these two constraints implies violation of the respective faithfulness constraints in (36a–b).

- (36) a. DEPLINK [lab]: Do not associate a [lab] feature to a segment that did not have it underlyingly.
- b. DEPLINK [dor]: Do not associate a [dor] feature to a segment that did not have it underlyingly.

When the trigger consonants are a labial /p, b, f, m/ and an emphatic /t̤, s̤, ð̤, f̤/, we can do without ALIGN [dor]-V̇. Instead, we incorporate the constraint schema for ES from chapter 3: L-ALIGN V-[dor]<sub>STEM</sub> >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEPLINK [dor]. This allows a unified analysis of labialization and emphasis. Tableau (37) illustrates a case of epenthetic /u/ that is triggered by an adjacent labial and a non-adjacent (initial) emphatic. Final clusters are not allowed, and hence the input faithful candidates (a) and (c) are rejected. Candidates that insert a default epenthetic /i/, like (37b), create a potential target that does not satisfy ALIGNMENT. (37d) aligns V-place[dor] to the right edge, and violates both \*V-[cor, dor] and ALIGN [lab]-V̇. (37f), on the other hand, spreads [lab] to the EV slot (resulting in an unrecognizable vowel) but it fails to spread V-place[dor]. The optimal candidate (37e) violates only lower-ranked faithfulness constraints.

- (37) \*COMPCODA, ALIGN [lab]-V̇, L-ALIGN V-[dor]<sub>STEM</sub> >> \*V-[cor, dor] >> R-ALIGN V-[dor]<sub>STEM</sub> >> DEP V-[cor], DEPLINK [dor], DEPLINK [lab]

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	//tʰabʔ//	*COMPCODA	ALIGN [lab]-V	L-ALIGN V-[dor] <sub>STEM</sub>	*V-[cor, dor]	R-ALIGN V-[dor] <sub>STEM</sub>	DEP V-[cor]	DEPLINK [dor]	DEPLINK [lab]
a.		*!				*			
b.			*!			*	*		
c.		*!						***	
d.			*!		*			****	
e.								****	*
f.						*!			*

Two other /u/-domains involve either a labio-velar /w/ or a back non-emphatic consonant (along with a labial). These triggers do not spread emphasis; and we must utilize the constraint ALIGN [dor]-V in (35b). On the other hand, in cases where the target vowels are underlyingly specified as V-place[cor] (//i//), one must account for delinking of the original place feature upon assimilation so that /u/ is realized. Recall from §3.3.4 that \*V-[cor, dor] is violable in certain contexts (e.g., leftward ES), so V-place [cor] is delinked only when [lab] spreads. I propose that the co-occurrence constraint \*V-[cor, lab] in (38a) outranks MAX V-[cor] (38b).

- (38) a. \*V-[cor, lab]: No segment should simultaneously have the features V-place [cor] and V-place[lab].
- b. MAX V-[cor]: Every V-place[cor] in the input has a correspondent V-place [cor] in the output.

Let us now consider labialization in (pre-specified) SV<sub>1</sub> of perfect verbs. The ranking in (39) captures the correct output for two types of triggers. The alignment constraints dictate that the features [lab] and [dor] be aligned to the target vowel (and attached to its V-place node) irrespective of their node association in the trigger, namely, C-place in //xibaz// and V-place in //wizan//. All candidates that fail on one or more alignment



constraints, resulting in a suboptimal SV<sub>1</sub>, are immediately rejected. Fatal violations of \*V-[cor, lab] eliminate outputs (e) which retain their V-place[cor]. This leaves /u/ as the optimal SV<sub>1</sub> in these contexts.

(39) ALIGN [lab]-V̥, ALIGN [dor]-V̥, \*V-[cor, lab] >> MAX V-[cor], DEPLINK [dor], DEPLINK [lab]

	// xibaz //	ALIGN [lab]-V̥	ALIGN [dor]-V̥	*V-[cor, lab]	MAX V-[cor]	DEPLINK [dor]	DEPLINK [lab]
a.		*!	*!				
b.		*!			*	*	
c.			*!		*		*
d.					*	*	*
e.				*!		*	*

	//wizan//	ALIGN [lab]-V̥	ALIGN [dor]-V̥	*V-[cor, lab]	MAX V-[cor]	DEPLINK [dor]	DEPLINK [lab]
a.		*!	*!				
b.		*!			*	*	
c.			*!		*		*
d.					*	*	*
e.				*!		*	*

The features pertinent to labialization do spread over intervening consonants. I have argued, however, that an acquired C-place[lab] or C-place[dor] feature often results in a non-contrastive segment that is invisible to phonology. In OT, such segments are disfavored by co-occurrence markedness constraints such as \*C-[lab] & [F] and \*C-[dor] & [F], where [F] stands for various other features. This is, of course, assuming an undominated NOGAP constraint.

Tableau (40) shows how the feature [lab] spreads from C<sub>3</sub> of certain perfect verbs to SV<sub>1</sub> through an intervening consonant upon deletion of SV<sub>2</sub>. Candidates (a) and (b) are rejected for their failure to comply with some alignment constraint(s). (40e) is ruled out by \*V-[cor, lab]. The non-contrastive segment /ʔ/ in (40c) realizes an extra C-place[lab] on underlying //r//, an option that is ruled out by \*C-[lab] & [F]. This candidate has /u/ as SV<sub>1</sub>, yet it is *harmonically bounded* by the optimal output (40d).

(40) ALIGN [lab]-V̄, ALIGN [dor]-V̄, \*V-[cor, lab] >> MAX V-[cor], DEPLINK [dor], DEPLINK [lab], \*C-[lab] & [F]

	//ʕirf-at//	ALIGN [lab]-V̄	ALIGN [dor]-V̄	*V-[cor, lab]	MAX V-[cor]	DEPLINK [dor]	DEPLINK [lab]	*C-[lab] & [F]
a.		*!	*!					
b.		*!			*	*		
c.					*	**	***	*!
d.					*	**	***	
e.				*!		*	***	

The above ranking also explains labialization of the stem and prefixal vowel(s) of measure I imperfect verbs. The input form in Tableau (41) has both of these potential target vowels. Therefore, total failure to assimilate indicates double violations of the assimilation-driving alignment constraints, as in (41a). Note that in the optimal output (40c), both C-place[lab] and C-place[dor] spread across intervening consonants. But

candidates (d) and (e), which realize these features contrastively on a consonant, are ruled out by \*C-[lab] & [F] and \*C-[dor] & [F], respectively.

- (41) ALIGN [lab]-V̥, ALIGN [dor]-V̥, \*V-[cor, lab] >> MAX V-[cor], DEPLINK [dor], DEPLINK [lab], \*C-[lab] & [F], \*C-[dor] & [F]

	//ji-brid//	ALIGN [lab]-V̥	ALIGN [dor]-V̥	*V-[cor, lab]	MAX V-[cor]	DEPLINK [dor]	DEPLINK [lab]	*C-[lab] & [F]	*C-[dor] & [F]
a.		*!*	*!*						
b.		*!	*!		*	*			
c.					**	***	***		
d.					**	***	***	*!	
e.					**	***	***		*!

The appearance of epenthetic /a/ when the first consonant of the cluster is /h, ʕ, h, x, ɣ/ has been explained as spreading of the feature [open] from a C- or a V-manner node. As discussed above, this process is specific to non-derived environments of the CaCC pattern, and the relevant alignment constraint (42a) is therefore morphologically indexed. The faithfulness constraint in (42b) militates against ALIGNMENT.

- (42) a. ALIGN [open]-EV<sub>ND</sub>: Given an output sequence CV̥ or V̥C (where V̥ = EV in the non-derived pattern CaCvC), the right/left edge of [open] must be aligned to the right/left edge of the sequence.
- b. DEPLINK [open]: Do not associate a feature [open] to a segment that did not have it underlyingly.

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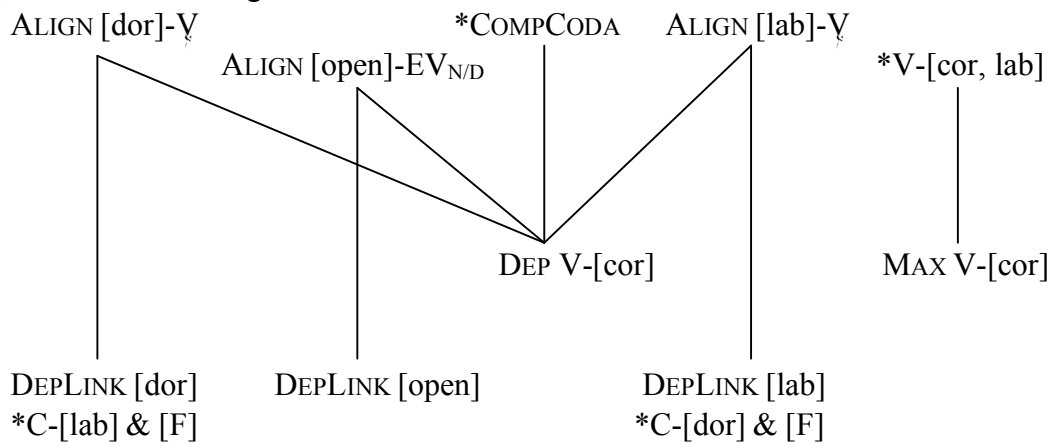
An instance of a trigger /h/ in a non-derived nominal is given in Tableau (43). Failure to comply with \*COMPCODA is fatal (43a). Candidate (b) has a default EV /i/ and it falls victim to ALIGNMENT. (43d) evades alignment violations by spreading [open] to an epenthetic /i/, violating both DEP V-[cor] and DEPLINK [open]. Only the latter constraint is violated by the optimal (43c). Because this is not an instance of labialization proper, details of other triggers will be disregarded.

(43) \*COMPCODA, ALIGN [open]-EV<sub>N/D</sub> >> DEP V-[cor], DEPLINK [open]

	//fahl//	*COMP CODA	ALIGN [open]- EV <sub>N/D</sub>	DEP V-[cor]	DEPLINK [open]
a.	f a h l   [open]	*!			
b.	f a h i l     [op] [cor]		*!		
c.	f a h a l   [op]				*
d.	f a h ? l     [op] [cor]			*!	*

The ranking schema for BA labialization is summarized in (44). Overall, ALIGNMENT and \*COMPCODA dominate faithfulness constraints against feature linkage.

(44) Constraint rankings for BA labialization



## 4.4 Conclusion

This chapter examined a number of morphological contexts in Cairene and Baghdadi that exhibit complementary distribution between /i/ and /u/ (and sometimes /a/). We have seen that the emergence of surface /u/—i.e., labialization—is largely predictable from the phonological environment.

The analysis confirms that feature specification must be done on a language-by-language basis, using explicit and overt evidence from the language in question. On the one hand, labialization in CA is restricted to a labio-velar trigger in the syllable onset. All evidence point toward the characterization of surface /u/ with a single V-place[lab]. In Baghdadi, the process is triggered by joint forces of labial and back consonants or by a single labio-velar glide. I proposed that underlying //u// in BA has only V-place[lab], but surface /u/ is composed of V-place[lab] and V-place[dor] that it could receive from surrounding consonants. But how does this take place?

A central claim in this chapter is that consonants and vowels can share features upon assimilation, even if those features associate with different parts of the segment-internal structure. The primary source for this claim is labialization triggers with C-place[dor] or C-place[lab] in BA. If we allow features to migrate from a consonantal to a vocalic node (Clements 1991), then labials and non-emphatic back consonants will align their respective C-place features to form (vocalic) /u/-domains. This, of course, builds on the premise that features such as [labial] and [dorsal] characterize consonants and vowels alike, even though they appear in different positions in the feature tree. And whereas spreading “one tier up” seems revolutionary from a standard dependency point of view (see e.g., Clements and Hume 1995), it makes correct predictions about various local C-V interactions in Arabic and other languages.

Another concern is the long-distance C-V spreading of place features. I adopted the view that C-features spread in a strictly local fashion, and spreading may not skip consonants that stand between trigger and target. However, no intervening consonants are affected in a contrastive, categorical, or even audible manner. What happens is that in the absence of contrast potential, spreading does not result in the feature being realized on these consonants (Ni Chiosáin and Padgett 2001; but see Jurgec 2010a). This and other facets of the analysis can be captured neatly in Optimality Theory if features are incorporated into the constraint formulation.



## CHAPTER 5

### Monophthongization

#### 5.1 Background

According to Ladefoged and Maddieson (1996:321), diphthongs are vowels with two non-homogenous targets or components. Yet the components of a diphthong are no different from those that occur as simplex vowels in a given language (*ibid.*). By definition, diphthongs may be rising (also known as on-glides) or falling (off-glides). Rising diphthongs, such as /ju/, are sequences of a semivowel plus vowel. Their onset glides are part of a syllable onset while their coda glides are part of the rime. This type of diphthong occurs in both Cairene and Baghdadi Arabic, as in the sequences /wi, wu, wa, ji, ju, ja/. In most phonology textbooks, however, the term “diphthong” is reserved for sequences of a low vowel followed by a high vowel, such as /ai, au/, that genuinely count as a single element in the language in question (Clark, Yallop, and Fletcher 2007:73). The discussion in this chapter is restricted to the latter type, commonly referred to as falling diphthongs.

Lindau, Norlin, and Svantesson (1985) estimate that about a third of the world’s languages have diphthongs, out of which 75 percent have the ai-type and 65 percent have the au-type diphthongs. Like pure vowels, diphthongs are influenced by their environment, and their vowel components vary widely in their total duration (Clark, et al. 2007:35). This chapter mainly discusses the diphthongs /ai/ and /au/ of CA and BA, but we also encounter similar sequences where the first element is /a:/ with the length digraph indicating its relative perceptual weight. Moreover, some of the diphthongs show an emphatic effect in the relevant context.

One may notice two different ways of transcribing a falling diphthong, namely, /ai/ versus /aj/. The former convention is used when the diphthong is purely vocalic (forming a syllabic nucleus), as in most European languages. In languages where the /i/ or /u/ target is clearly not the dominant component of the diphthong, they may be treated as nonsyllabic semivowels /j, w/ (*ibid.*, p.72). This is especially true where the second element of the diphthong has some consonantal value, as in Arabic and some Australian Aboriginal languages (*ibid.*). In Arabic, it has been claimed that the glides /j/ and /w/ are formed from high front and high back vowels if they are preceded by a

low vowel /a/ (Benhallam 1980:32). These glides have a consonantal function in that they may replace the consonantal radicals in Arabic root-and-pattern morphology (Cantineau 1960:104),<sup>1</sup> even though they do not behave like full consonants. There is further evidence that glides do not add weight to a word-final syllable just like coda consonants, which would not be expected if they were purely vocalic. That being the case, I transcribe CA and BA diphthongs with a final glide element.

Diphthongs of many languages undergo coalescence or reduction to a single pure vowel (monophthong). This process is commonly referred to as monophthongization. As reduction, it is characterized by feature deletion whereby one of the diphthongal elements is lost. One such pattern is the reduction of the diphthong /ai/ to a long low vowel monophthong /a:/ in some varieties of Southern States English and African-American English (Mendoza-Denton et al. 2001). For example, words such as *right* and *time* are pronounced as /rat/ and /ta:m/. As coalescence, it involves a merger of features in the vocalic components of the underlying diphthong. Monophthongization takes place both as historical and ongoing change. A change of the former type is /aj/ → /ɛ/ and /əj/ → /e/ in 18<sup>th</sup> century Korean (Ahn and Iverson 2006), while a change in-progress is /aɛ/ → /ɛ:/ and /aɔ/ → /ɔ:/ in Austrian German (Moosmüller 1997). Note that the length of the diphthong is usually preserved in the long vowel.

Another example is the coalescence of Old Arabic diphthongs /aj/ and /aw/ into the long mid vowels /ee/ and /oo/ in modern Arabic dialects. This is a geographically widespread phenomenon observed in most dialects of Egypt, Libya, Central Sudan, the Levant, Mesopotamia, and a few dialects in Tunisia and the Arabian Peninsula (Fischer and Jastrow 1980:55, Iványi 2006:642). It is not known exactly when this change took place, but Diem (1985) provides evidence that in the seventh century A.D. there were no signs of monophthongization. All the same, it is widely believed to be a historical process that no longer applies, and, as a consequence, the synchronic status of long mid vowels and diphthongs in the modern dialects has received little attention in the literature. The aim of this chapter is to thoroughly examine these synchronic distributions in CA and BA. I provide robust evidence as to the predictability of long mid vowels and diphthongs, suggesting that monophthongization is an active synchronic process that fails to apply in particular environments, both phonological and morphological. Another central argument draws on McCarthy's (2005b) hypothesis that learners project underlying representations from the morphophonemic alternations that they observe.

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<sup>1</sup> As in many other Semitic languages, every Arabic word has a lexical root, that is, a set of consonants in a specific order that embody a broad lexical meaning (Ryding 2005), while the vowels and other affixal consonants generally have a grammatical function (Bellem 2007:21). Roots usually consist of three, but sometimes two or four, segments. They combine non-concatenatively with a vocalic melody within certain templatic patterns (Beesley 1998). The consonants k-t-b, for example, appear in a number of words related to the activity of writing (*katab* 'he wrote', *kita:b* 'book', *kita:bah* 'writing', *ka:tib* 'writer', *maktabah* 'library' and so on).



## 5.2 Monophthongization in Cairene Arabic\*

This section provides a detailed account of the monophthongization facts in Cairene Arabic. CA is one of those Arabic dialects where historical diphthongs are generally substituted by the long mid vowels /ee/ and /oo/. However, when considering the synchronic status of CA mid vowels and diphthongs, three facts stand out as particularly intriguing. First is the absence of short mid vowels in CA. Second are the systematic exceptions to monophthongization in which diphthongs appear on the surface. Third is the fact that the language contrasts long mid vowels with diphthongs in specific morphological environments.

To resolve these difficulties, it has been suggested that monophthongization is at best a historical process, and that long mid vowels are underlying in CA (Broselow 1976:152). However, careful examination of the distribution of mid vowels and diphthongs shows the latter proposal to be inaccurate and suggests that these mid vowels are only—and still—derived from underlying diphthongs in this dialect. In doing so, I argue that monophthongization in Cairene 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. Representationally, the process is analyzed as a type of place assimilation.

The remainder of this section is organized as follows. Section 5.2.1 lays out the surface inventory of CA monophthongs, and argues against the existence of short mid vowels. Section 5.2.2 thoroughly examines the morphological distribution of mid vowels and diphthongs in CA, by classifying the relevant forms under a certain type of weak root. Section 5.2.3 explains the occurrence of long mid vowels as the result of total assimilation of two adjacent vocalic root nodes of an underlying diphthong. Then it shows how dialect-specific phonological processes block the application of monophthongization within various patterns. Section 5.2.4 formulates these processes in Optimality Theory through the interaction of general markedness and faithfulness constraints with positional faithfulness (Beckman 1998) and Optimal Paradigms constraints (McCarthy 2005a). Significantly, the last type of constraints accounts for the morphologically conditioned diphthongs that alternate with mid vowels—without having to make reference to different levels of representation.

### 5.2.1 Surface Monophthongs in CA

Cairene Arabic has four short vowels /i, u, a, ʌ/ and four corresponding long vowels /i:, u:, a:, ʌ:/ plus two additional long mid vowels /ee/ and /oo/ with no corresponding short vowels. The long vowels /ee/ and /oo/ exhibit several contrasts with both long-high and long-low vowels and with each other, as shown in (1a–c).

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\* This section is a revised and modified version of a paper entitled “Against Underlying Mid Vowels in Cairene Arabic”, published in *Zeitschrift für Arabische Linguistik* 52: 5–38 (Youssef 2010b).

## (1) Contrasts involving long mid vowel

a.	<i>meel</i>	‘inclination’	<i>mi:l</i>	‘incline! MS’
	<i>bēed<sup>f</sup></i>	‘eggs’	<i>bī:d<sup>f</sup></i>	‘lay eggs! MS’
	<i>moot</i>	‘death’	<i>mut</i>	‘die! MS’
	<i>ḍoḍ<sup>r</sup></i>	‘turn N’	<i>ḍur<sup>r</sup></i>	‘turn! MS’
b.	<i>beet</i>	‘house’	<i>bat</i>	‘he spent the night’
	<i>tēer<sup>f</sup></i>	‘birds’	<i>tā:r<sup>f</sup></i>	‘he flew’
	<i>loom</i>	‘blame N’	<i>lam</i>	‘he blamed’
	<i>sōom</i>	‘fasting’	<i>sā:m</i>	‘he fasted’
c.	<i>meel</i>	‘inclination’	<i>mool</i>	‘mall’
	<i>tēer<sup>f</sup></i>	‘birds’	<i>toḍ<sup>r</sup></i>	‘bull’

The six surface long vowels /i:, u:, a:, ɑ:, 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 CA does not permit more than one long vowel in the phonological word (Abdel-Massih 1975:24). The four short vowels /i, u, a, ɑ/ on the other hand may be in stressed, pre-stress, or post-stress position. They may be followed by one or no consonants or word-finally by two (ibid.).

While there is consensus among researchers as to classifying the 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 (Drozdk 1974:125). Birkeland (1952:48–9), on the one hand, 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 absent 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, such as the opposition between the masculine plural ending *-in* from the dual ending *-een*.

On the other hand, Abdel-Massih (1975) obtains words with short /e/ and /o/ by adding pronominal suffixes to verbs and nouns with long /ee/ and /oo/ vowels. By means of a rule shortening long vowels before two consonants, the following minimal pair is elicited: *bet-na* ‘our house’ (from *beet* ‘house’) as opposed to *bit-na* ‘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/ (Norlin 1987:47–9). Watson (2002: 228) suggests that when an unstressed long mid vowel is shortened, 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 (see Gary and Gamal-Eldin 1982:128, Woidich 2006a:7). Examples of these neutralizations are given in (2).

## (2) Neutralization of /ee/–/i:/ contrasts to short /i/

<i>din</i>	‘religion’	<i>deen</i>	‘debt’	<i>din-na</i>	‘our religion/ our debt’
<i>ḍi:f</i>	‘add!’	<i>ḍeef</i>	‘guest’	<i>ḍif-na</i>	‘we added/ our guest’
<i>yir</i>	‘envy!’	<i>yeer</i>	‘other’	<i>yir-na</i>	‘we envied/ other than us’
<i>bus</i>	‘kiss!’	<i>boos</i>	‘kissing’	<i>bus-ha</i>	‘kiss her!/ her kissing’
<i>mut</i>	‘die!’	<i>moot</i>	‘death’	<i>mut-na</i>	‘we died/ our death’
<i>ṛu:ḥ</i>	‘go!’	<i>ṛoḥ</i>	‘soul’	<i>ṛuḥ-na</i>	‘we went/ our soul’
<i>ḍu:ṛ</i>	‘turn!’	<i>ḍoṛ</i>	‘turn N’	<i>ḍuṛ-na</i>	‘we turned/ our turn’
<i>fu:ʔ</i>	‘sober!’	<i>fooʔ</i>	‘above’	<i>fuʔ-na</i>	‘we sobered/ above us’

The final concern of this section is vowel length. Because 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 1952:31 ff.). In stressed non-final open syllables, however, both long and short vowels may occur in minimal or near-minimal pairs (3). In such cases, the length feature is always predictable from the morphological class (templatic form) of the word.<sup>2</sup> Based on these observations, Birkeland maintains that vowel length is the redundant element of the length-stress correlation. We conclude that long and short vowels are featurally identical and differ only in having one or two moras on the suprasegmental level (§5.2.3).

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

<i>sibtini</i>	‘you FS left me’	<i>sibtini</i>	‘you MS left me’
<i>sinnu:hum</i>	‘grind PL them!’	<i>sinnuhum</i>	‘grind MS them!’
<i>ma:lik</i>	‘your FS money’	<i>malik</i>	‘king’

The chart in (4) summarizes the monophthongal vowel inventory of Cairene Arabic (ignoring the “derived” pharyngealized counterparts of non-low vowels).

## (4) Chart: surface vowel monophthongs in CA

	Front	Back
High	i(:)	u(:)
Mid	ee	oo
Low	a(:)	ɑ(:)

<sup>2</sup> Based on impressionistic observations, Cowan (1970) claims that CA has no consistent use of vowel length in fast speech, and that all vowels exhibit some degree of length variation depending on syllable structure, voicing and stress, or stylistic factors. He therefore argues for a system where only quality is pertinent, i.e., an eight-simple-vowel analysis of Cairene Arabic /i, ɪ, e, a, o, u, ʊ, ə/ rather than three short vowels and five long ones.

### 5.2.2 The Distribution of Monophthongs and Diphthongs in CA

From the above discussion, we infer that the vowel system of Cairene Arabic 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 2005b:22). As a matter of fact, CA long mid vowels are claimed to have historically developed from OA sequences of vowel plus glide (see e.g., Birkeland 1952, Robertson 1970). This is schematized as follows.

(5)	<i>OA</i>	<i>example</i>		<i>CA</i>	<i>example</i>	<i>gloss</i>
	/aj/	dʔajf	→	/ee/	dʔeef	‘guest’
	/aw/	fawk	→	/oo/	fook	‘thorn’

In some environments, however, Cairene has kept the diphthongs /aj, aw/<sup>3</sup> instead of the expected /ee, oo/—in which case CA and OA forms are identical with respect to their surface diphthongs. The rest of this section presents the morphological contexts in which diphthongs and long mid vowels surface in CA. The main sources of these segments are roots that include a semivowel /j/ or /w/. This is because the semivowels 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, roots can be classified into three groups: initial-weak roots which begin with a semivowel, medial-weak (hollow) roots in which the second radical is a semivowel, and final-weak (defective) roots where the final radical is a semivowel (ibid.); or a combination of two positions excluding “initial and medial” (Gadalla 2000:58).

#### 5.2.2.1 Initial-Weak Roots GCC

In derivations of initial-weak roots, Cairene retains the diphthongs /aj/ and /aw/ in the comparative adjectives (6a), requestive or estimative verbs and their active participles (6b), passive participles (6c), verbal nouns (6d), and some broken plurals (6e). All these cases involve the fusion of two morphological elements, viz., a prefix ending in

<sup>3</sup> In chapter 3, we discussed the phonemic split in the low vowel between a front /a/ and a back /ɑ/. This logically implies a split in the diphthongs between front /aj, aw/ and back /ɑj, ɑw/, and even a further split in their corresponding long mid vowels. While such splits are natural in plain vs. emphatic environments (i.e., on the surface), you may recall that, due to changes in the vocalic melody of Arabic morphemes, underlying emphatic /ɑ/ is only assumed where no other potential consonantal emphatics exist. This is a limited class of words in which no lexical items include a mid vowel or a diphthong. Thus, in the current chapter, I will restrict the discussion to the diphthongs /aj/ and /aw/ (with front /a/) and their corresponding mid vowels.

/a/ and a stem beginning with a glide (see also chapter 3, fn.10).<sup>4</sup> Word stress is not indicated, but I should mention that the diphthong may be stressed or unstressed depending on the stress assignment rules of the language.

(6) Diphthongs across morpheme boundaries (initial-weak radicals)

a.	<i>ʔa-wgab</i>	‘more necessary’	<i>ʔa-wgab</i>	‘more elegant’
	<i>ʔa-wfar<sup>f</sup></i>	‘more economical’	<i>ʔa-wsax</i>	‘dirtier’
	<i>ʔa-wsaʃ</i>	‘wider’	<i>ʔa-whaʃ</i>	‘uglier’
	<i>ʔa-jman</i>	(male name)	<i>ʔa-ʃsar<sup>f</sup></i>	‘easier’
b.	<i>ʔista-wʃib</i>	‘he comprehended’	<i>mista-wʃib</i>	‘comprehending’
	<i>ʔiʃta-wr<sup>f</sup>ad</i>	‘he imported’	<i>muʃta-wr<sup>f</sup>ad</i>	‘imported ADJ’
	<i>ʔiʃta-wz<sup>f</sup>aʃ</i>	‘he obtained a post’	<i>muʃta-wz<sup>f</sup>aʃ</i>	‘one who has a job’
	<i>ʔiʃta-ʃsar<sup>f</sup></i>	‘he considered easy’	<i>miʃta-ʃsar<sup>f</sup></i>	‘considering easy’
c.	<i>ma-wʃu:d</i>	‘promised’	<i>ma-wzu:n</i>	‘balanced’
	<i>ma-wsu:ʃa</i>	‘encyclopedia’	<i>ma-wd<sup>f</sup>u:ʃ</i>	‘topic’
	<i>ma-wʔaf</i>	‘parking’	<i>ma-whiba</i>	‘talent’
	<i>ma-jmu:n</i>	‘blessed’	<i>ma-ʃsu:r<sup>f</sup></i>	‘well-off’
d.	<i>ta-wri:d</i>	‘supplying’	<i>ta-wr<sup>f</sup>i:t<sup>f</sup></i>	‘embarrassing’
	<i>ta-ws<sup>f</sup>i:l</i>	‘delivering’	<i>ta-wsi:ʃ</i>	‘widening’
	<i>ta-wd<sup>f</sup>i:h</i>	‘explaining’	<i>ta-wd<sup>f</sup>i:b</i>	‘arranging’
	<i>ta-wki:l</i>	‘power of attorney’	<i>ta-ʃsi:r</i>	‘facilitating’
e.	<i>ʔa-wt<sup>f</sup>a:n</i>	‘home countries’	<i>ʔa-wza:n</i>	‘weights’
	<i>ʔa-wla:d</i>	‘boys’	<i>ʔa-wba:ʃ</i>	‘bastards’
	<i>ʔa-wr<sup>f</sup>a:m</i>	‘tumors’	<i>ʔa-wt<sup>f</sup>a:r<sup>f</sup></i>	‘strings’
	<i>ʔa-jta:m</i>	‘orphans’	<i>ʔa-jma:n</i>	‘oaths’

Two other classes surface with diphthongs across morpheme boundaries, with no corresponding diphthong in OA. These cases are clear evidence against the claim that all CA diphthongs have an origin in OA. The first class is the prefixed first person singular imperfect verbs (7a), whose OA correspondents drop the first root consonant altogether, e.g., *ʔazin* ‘I weigh’ (Ryding 2005:460). Interestingly, CA also preserves diphthongs that span two stem morphemes when the initial glide of the second morpheme syllabically adjoins preceding segments after some phonological changes (see §5.2.3). The formation of these phrase-level diphthongs is schematized in (7b).

<sup>4</sup> An alternative explanation is offered by way of *Systemzwang*, i.e., root-pattern pressure for root triconsonantality (Ferguson 1957:463). Proponents of this analysis maintain that a diphthong /aw/ in a word like *mawzu:n* ‘balanced’ is not monophthongized to /oo/ because a conceivable form *moozu:n* would not be recognizable as the concatenation of the three root radicals  $\sqrt{wzn}$ , viz., the morphological word pattern would become opaque (Woidich 2006b:325). Once we assume that all long mid vowels are derived (see below), this argument becomes invalid.

## (7) Diphthongs across morpheme/word boundaries (with no OA cognates)

a.	<i>ʔa-wzin</i>	‘I weigh’		<i>ʔa-wgaʕ</i>	‘I hurt’	
	<i>ʔa-wʕid</i>	‘I promise’		<i>ʔa-wsʕal</i>	‘I arrive’	
	<i>ʔa-wsʕif</i>	‘I describe’		<i>ʔa-wlaʕ</i>	‘I burn’	
	<i>ʔa-wlid</i>	‘I give birth’		<i>ʔa-wris</i>	‘I inherit’	
b.	<i>maʕa</i>	‘with’	+ <i>wila:d</i>	‘boys’	→ <i>ma.ʕaw.la:d</i>	‘with boys’
	<i>ʕadda</i>	‘he crossed’	+ <i>jimi:n</i>	‘right’	→ <i>ʕa.ddaj.mi:n</i>	‘he crossed right’
	<i>wisʕil</i>	‘he arrived’	+ <i>ma...ʕ</i>	‘not’	→ <i>maw.sʕilʕ</i>	‘he didn’t arrive’
	<i>ji-ʔu:l</i>	‘he says’	+ <i>ma...ʕ</i>	‘not’	→ <i>maj.ʔulʕ</i>	‘he doesn’t say’

## 5.2.2.2 Medial-Weak Roots CGC/CGCC

Most generic and common nouns from medial-weak roots surface with the long mid vowels /ee/ and /oo/, as shown in (8a–b). All these forms have other morphologically related lexical items (usually involving different syllable or morpheme shapes) where the radical glide is bound to emerge. For each target form, one such example is displayed under the alternation column.

## (8) Long mid vowels in nouns

	<i>target</i>		<i>alternation</i>		√
a.	<i>meel</i>	‘slant’	<i>ma:ʕil</i>	‘bending’	bjʕ
	<i>tʕeərʕ</i>	‘bird’	<i>tʕajja:rʕ</i>	‘pilot’	tʕr
	<i>ʕeeb</i>	‘shame’	<i>ʕajjib</i>	‘he criticized’	ʕjb
	<i>xeeʕʕ</i>	‘thread’	<i>xajjaʕʕ</i>	‘he sewed’	xjʕʕ
	<i>yeerʕ</i>	‘other’	<i>ʔityajja:rʕ</i>	‘he changed’	ʔjrʕ
	<i>ʕeen</i>	‘eye’	<i>ʔaʕjan</i>	‘notables’	ʕjn
	<i>ʕeela</i>	‘burden’	<i>ʕijal</i>	‘burdens’	ʕjl
	<i>ʔeed</i>	‘entry’	<i>taʔji:d</i>	‘registering’	ʔjd
	<i>gineena</i>	‘garden’	<i>gana:ʕin</i>	‘gardens’	gnn
b.	<i>ʕooza</i>	‘want N’	<i>ʕa:wiz</i>	‘wanting’	ʕwz
	<i>xoof</i>	‘fear’	<i>xawwa:f</i>	‘timid’	xwf
	<i>moot</i>	‘death’	<i>mawwit</i>	‘he killed’	mwt
	<i>gooz</i>	‘husband’	<i>ʕiggawwiz</i>	‘he married’	gwz
	<i>zooʔ</i>	‘taste’	<i>zawwaʔ</i>	‘he decorated’	zwʔ
	<i>ḍoʔrʕ</i>	‘turn’	<i>ʔaḍwa:rʕ</i>	‘turns’	dwrʕ
	<i>nooba</i>	‘fit’	<i>nuwab</i>	‘fits’	nwb
	<i>noom</i>	‘sleep’	<i>tanwi:m</i>	‘causing to sleep’	nwm

All adjectival forms that display this pattern are feminine adjectives denoting color and physical characteristics (Gadalla 2000:161). As shown in (9), some of their morphological alternations have the radical glides /j/ or /w/.

## (9) Long mid vowels in adjectives

<i>target</i>		<i>alternation</i>		√
<i>bēdʿa</i>	‘white FS’	<i>ʔibjadʿdʿ</i>	‘it turned white’	bjdʿ
<i>sooda</i>	‘black FS’	<i>sawa:d</i>	‘blackness’	swd
<i>ʔoʔrʿa</i>	‘one-eyed FS’	<i>ʔaʔwarʿ</i>	‘one-eyed MS’	ʔwr
<i>ħoola</i>	‘squint-eyed FS’	<i>ʔaħwal</i>	‘squint-eyed MS’	ħwl
<i>foola</i>	‘left-handed FS’	<i>ʔafwal</i>	‘left-handed MS’	fwl

All target words in (8) and (9) include the sequence CeeC or CooC where only two consonants appear, while the glide medial radical surfaces in other templatic patterns of the same root (none of which includes a mid vowel). Corresponding forms from sound roots have the shape CaCC, and otherwise identical templatic patterns (where C<sub>2</sub> replaces a glide). Comparing the target forms in (10a–b) with (8) and (9) above, we conclude that they are derived from the same underlying template CaCC. Once native speakers encounter a medial-weak root, they have synchronic evidence for underlying //CaGC// (where G stands for glide), and so the underlying diphthongal sequence //aG// creates a surface long mid vowel /ee/ or /oo/ via monophthongization (see Broselow 1976:149). This synchronic evidence for the underlying nature of CA long mid vowels coincides with diachronic evidence from OA, whose corresponding target forms include the diphthongs /aj/ and /aw/.

## (10) Sound roots

	<i>target</i>		<i>alternation</i>		√
a.	<i>fath</i>	‘opening’	<i>fa:tiħ</i>	‘opening’	fth
	<i>sʿarʿf</i>	‘spending’	<i>sʿarʿrʿa:f</i>	‘cashier’	sʿrf
	<i>ʔadl</i>	‘justice’	<i>ʔaddil</i>	‘he amended’	ʔdl
	<i>batʿn</i>	‘belly’	<i>batʿʿan</i>	‘he padded’	btʿn
	<i>malħ</i>	‘salt’	<i>ʔitmallaħ</i>	‘it got salted’	gww
	<i>sʿamʿf</i>	‘type’	<i>ʔasʿna:f</i>	‘types’	sʿnf
	<i>gazma</i>	‘shoe’	<i>gizam</i>	‘shoe’	gzm
	<i>maʿsrʿaħ</i>	‘theatre’	<i>masariħ</i>	‘theatres’	srʿħ
b.	<i>ħamrʿa</i>	‘red FS’	<i>ʔiħmarʿrʿ</i>	‘it turned red’	ħmrʿ
	<i>ħadrʿa</i>	‘green FS’	<i>ħadʿarʿ</i>	‘greenness’	ħdrʿ
	<i>ħarʿsʿa</i>	‘mute FS’	<i>ʔaħrʿasʿ</i>	‘mute MS’	ħrsʿ

On the other hand, there is a significant group of Cairene verbs and nouns with long /ee/ and /oo/ in their first syllable that have no correspondents in OA (11a–b). These provide evidence that monophthongization is not sensitive to the stem-final position as claimed by Gadalla (2000). Most of these, in addition to loanwords with non-initial long mid vowels (11c), have no morphological alternations that include a glide /j/ or /w/ (Carter 1996:139). This denotes the lack of direct synchronic evidence to posit

underlying diphthongs for surface /ee/ and /oo/.<sup>5</sup> But 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 2005b) by deriving them from an underlying diphthongal base. While the theory also allows us to posit underlying mid vowels for the non-alternating forms, the grammar that derives them from underlying diphthongs is more restrictive (*ibid.* p.38).

## (11) Long mid vowels in words of non-OA origin

a.	<i>boolaʔ</i>	‘he burped’	<i>sooraʔ</i>	‘he fainted’
	<i>dooḥas</i>	‘it abscessed’	<i>ḍoḍḥarʔ</i>	‘he kept at it’
	<i>foolaḥ</i>	‘he stripped off’	<i>sooḡarʔ</i>	‘he locked up’
	<i>xoozaʔ</i>	‘he impaled’	<i>?it-ʔoolaʔ</i>	‘he behaved immorally’
b.	<i>mooḍʔa</i>	‘fashion’	<i>noota</i>	‘note’
	<i>noovi</i>	‘brand-new’	<i>?ooḍʔa</i>	‘room’
	<i>beeraʔ</i>	‘banner’	<i>zeebaʔ</i>	‘mercury’
	<i>leɛzarʔ</i>	‘laser’	<i>ʃeɛdarʔ</i>	‘Cheddar’
	<i>keelu</i>	‘kilo’	<i>keeka</i>	‘cake’
c.	<i>sʔaʔooḥ</i>	‘salon’	<i>dibloom</i>	‘diploma’
	<i>ḍuktoorʔ</i>	‘doctor’	<i>miljoon</i>	‘million’
	<i>balloona</i>	‘balloon’	<i>bansjoon</i>	‘apartment house’
	<i>tilifizjoon</i>	‘television’	<i>sifoon</i>	‘siphon’
	<i>sʔubbeɛtʔ</i>	‘calamari’	<i>sikirteer</i>	‘secretary’

Morphemes that exhibit a geminate glide in their templatic pattern preserve surface diphthongs. (12a) is a group of monosyllabic words, (12b) is a group of causative and reflexive measure III and V verbs, and (12c) is a group of derivations of measure II verbs, including adjectives of intensity, nouns of instrument and profession, as well as broken plurals of some lexicalized participles—their paradigms naturally exhibit a similar effect. Many of the forms in (12b–c) have morphological alternations with a mid vowel, supporting a coalescent source (see also (8)).

## (12) Geminate glides as blockers to monophthongization

a.	<i>zajj</i>	‘like’	<i>?ajj</i>	‘any’
	<i>ḥajj</i>	‘alive’	<i>najj</i>	‘raw’
	<i>gaww</i>	‘atmosphere’	<i>saww</i>	‘badness’
b.	<i>baɛjɛdʔ</i>	‘he painted’	<i>sajjaḥ</i>	‘he melted’
	<i>ʔajjin</i>	‘he appointed’	<i>?itkajjif</i>	‘he adapted’

<sup>5</sup> A few words in (11) display a glide in their morphological paradigm, as in *?ooḍʔa* ‘room’ / *?uwaɛdʔ* ‘rooms’ and *sikirteer* ‘secretary’ / *sikirtarja* ‘secretaryship’. This provides further evidence that native speakers will assume an underlying weak root (with a medial glide) for loanwords that have long mid vowels on the surface.



	<i>nawwaʕ</i>	‘he verified’	<i>sʕawwaʕ</i>	‘he photographed’
	<i>zawwid</i>	‘he increased’	<i>?itʕawwaʕ</i>	‘he volunteered’
c.	<i>ʕajja:l</i>	‘porter’	<i>majja:l</i>	‘inclined’
	<i>tʕajja:rʕ</i>	‘pilot’	<i>tʕajja:rʕa</i>	‘plane’
	<i>bajja:ʕ</i>	‘salesman’	<i>bajja:ʕa</i>	‘salesmen’
	<i>sawwa:?</i>	‘driver’	<i>ʕawwa:d</i>	‘oud player’
	<i>ʕawwa:la</i>	‘bean pot’	<i>gawwa:la</i>	‘boy scouts’
	<i>?awwil</i>	‘first’	<i>xawwa:f</i>	‘timid’

Some derivationally unproductive or semi-productive words in CA tend to retain the diphthongs /aj/ and /aw/ stem-medially (as in OA). These comprise three categories. First is the class of nouns and verbs derived from quadrilateral consonantal roots, as in (13).<sup>6</sup> Most quadrilaterals were derived historically either from biliteral roots by complete reduplication, or from trilateral roots by various processes of extension: through reduplication of C<sub>1</sub> or C<sub>3</sub>, insertion of an augmenting consonant as C<sub>2</sub> or C<sub>3</sub> (commonly sonorants), or addition of C<sub>4</sub> (Holes 1995:86). Quadrilaterals have also been—and continue in the modern period to be—derived from nominal or adjectival sources or foreign borrowings (ibid.). Watson (2002) notes that quadrilateral verbs are derivationally unproductive, usually having at most one derived verbal form through prefixation of *?it-* (p.143). An exception is the prefix *?isti-* which can be added to a few quadrilateral verbs.

(13) Surface diphthongs in words of quadrilateral origin

<i>lawlab</i>	‘spiral’	<i>kawkab</i>	‘planet’
<i>ḡawḡarʕ</i>	‘core’	<i>ḡawḡarʕ</i>	(female name)
<i>tawʕam</i>	‘twins’	<i>hajkal</i>	‘internal structure’
<i>ʕawʕarʕa</i>	‘interference’	<i>zawbaʕa</i>	‘tornado’
<i>ʕawlama</i>	‘globalization’	<i>qawqaʕa</i>	‘shell’
<i>hawhaw</i>	‘he barked’	<i>nawnaw</i>	‘he mewed’
<i>sʕawsʕaw</i>	‘he cheeped’	<i>lawliw</i>	‘he twisted’
<i>sʕajtʕarʕ</i>	‘he dominated’	<i>sʕajtʕarʕa</i>	‘domination’
<i>ʕajtʕana</i>	‘naughty behavior’	<i>sʕajdaʕijja</i>	‘pharmacy’

Second are nouns derived from hollow roots whose corresponding verbs exceptionally maintain the medial glide—with no gemination—throughout their perfect and imperfect paradigms. One subtype (14a) is associated with causative verbs that denote “to cause a defect” (Abboud 1976:179). Another subtype (14b) is derived from doubly weak roots (where the last two radicals are glides). These nouns would

<sup>6</sup> If we generalize that quadrilateral derivations do not undergo monophthongization, then the following words with long mid vowels are exceptions: *heekal* (male name), *ʕeʕsʕal* (Cairo district), *beeda?* ‘pawn (chess)’, *zoora?* ‘small boat’, and *doora?* ‘pitcher’.

otherwise surface with a diphthong /ooj/, which does not exist in CA (Harrell 1957: 65). I will treat the limited cases in (14) as lexical exceptions.

(14) Surface diphthongs in exceptional classes of hollow roots

a.	<i>dawfa</i>	‘loud noise’	<i>hawsa</i>	‘bedlam’
	<i>xawta</i>	‘craziness’	<i>ʕawga</i>	‘crook’
	<i>lawħa</i>	‘a twist’	<i>zawra</i>	‘a choke’
	<i>rawfa</i>	‘distractedness’	<i>rawfana</i>	‘hipness’
b.	<i>kawj</i>	‘ironing’	<i>lawj</i>	‘twisting’
	<i>ʕawj</i>	‘roasting’	<i>ʕaw-ju</i>	‘its roasting’

The last set comprises recent or established foreign borrowings (15a), and Standard Arabic borrowings from trilateral roots (15b). These are either completely lexicalized or semi-productive but have no verbal derivatives. Recall that most speakers of CA are exposed to some oral use of Standard Arabic, and that many educated speakers use a large number of loanwords in their ordinary speech. Thus a technical term may be borrowed in Cairene with the diphthong (Ferguson 1957:466); compare *dawra* ‘tournament’ to the more nativized *ḍora* ‘bathroom’—both derived from the same consonantal root  $\sqrt{dwr}$ .

(15) Surface diphthongs in foreign and Standard Arabic loanwords

a.	<i>tawla</i>	‘backgammon’	<i>tawra</i>	‘Torah’
	<i>qawloon</i>	‘colon’	<i>fajruz</i>	‘turquoise’
	<i>tajfud</i>	‘typhus’	<i>qajsari</i>	‘Caesarean’
	<i>bajrut</i>	‘Beirut’	<i>najlun</i>	‘nylon’
b.	<i>dawla</i>	‘state’	<i>lajla</i>	(female name)
	<i>ḥawd</i>	‘chaos’	<i>ḥawra</i>	‘private parts’
	<i>rāwfa</i>	‘marvelousness’	<i>dawra</i>	‘stage/ tournament’
	<i>qawla</i>	‘round’	<i>qawmi</i>	‘national’
	<i>ṣawra</i>	‘revolution’	<i>ṣawraqi</i>	‘rebel’

### 5.2.2.3 Opaque Cases of Medial Weak Radicals

A challenging set of data consists of related minimal pairs from hollow verbs in which mid-vowel monophthongs alternate with diphthongs. The left-hand column in (16) denotes feminine singular active participles and the right-hand column denotes the matching nouns of instance.<sup>7</sup>

<sup>7</sup> 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., *rāṣṣ* ‘dancing’), whereas the individual instance is often feminine singular (e.g., *rāṣṣa* ‘a dance’) (Ryding 2005:89).

## (16) Alternations involving diphthongs vs. mid vowels

<i>ʕawz-a</i>	‘wanting FS’	<i>ʕooz-a</i>	‘want N’
<i>ʕajl-a</i>	‘carrying FS’	<i>ʕeel-a</i>	‘burden’
<i>ʕajb-a</i>	‘absent FS’	<i>ʕeeb-a</i>	‘absence’

To reconcile these alternations, Broselow (1976:152–3) argues that monophthongization in Cairene was a historical process that no longer applies. As a consequence, 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, while the monophthongal forms in (17c) can be derived from underlying diphthongs based on the above evidence, the diphthongs in (17b) are not subject to monophthongization because they are fed by earlier phonological rules (Watson 2002:23). This becomes evident if we compare the feminine singular participles in (17b) to the corresponding masculine forms in (17a).<sup>8</sup> Moreover, the last four rows in (17) show that the diphthong /aj/ of the feminine participle is actually not related to the nominal form with a long mid vowel (where /oo/ surfaces).

## (17) Contrasting active participle and nouns of instance

√	a.	b.	gloss	c.	gloss
	PARTICIPLE			NOUN	
	MS	FS			
ʕwz	<i>ʕa:wiz/ʕa:jiz</i>	<i>ʕawza ~ ʕajza</i>	‘wanting’	<i>ʕooza</i>	‘want N’
ʕjl	<i>ʕajil</i>	<i>ʕajla</i>	‘carrying’	<i>ʕeela</i>	‘burden’
xjb	<i>xa:jib</i>	<i>xajba</i>	‘hopeless’	<i>xeeba</i>	‘failure’
hjs <sup>ʕ</sup>	<i>ħa:jis<sup>ʕ</sup></i>	<i>ħajs<sup>ʕ</sup>a</i>	‘excited’	<i>ħees<sup>ʕ</sup>a</i>	‘excitement’
zjt <sup>ʕ</sup>	<i>za:jit<sup>ʕ</sup></i>	<i>zajt<sup>ʕ</sup>a</i>	‘uproarious’	<i>zeet<sup>ʕ</sup>a</i>	‘uproar’
ʕjb	<i>ʕajib</i>	<i>ʕajba</i>	‘hoary’	<i>ʕeeba</i>	‘gray hair’
bjʕ	<i>ba:jif</i>	<i>bajʕa</i>	‘selling’	<i>beeʕa</i>	‘sale’
bjd <sup>ʕ</sup>	<i>ba:jid<sup>ʕ</sup></i>	<i>bajd<sup>ʕ</sup>a</i>	‘laying eggs’	<i>beed<sup>ʕ</sup>a</i>	‘egg’
ʕjb	<i>ʕajib</i>	<i>ʕajba</i>	‘indecent’	<i>ʕeeba</i>	‘shame’
mjl	<i>ma:jil</i>	<i>majla</i>	‘tilting’	<i>meela</i>	‘inclination’
ʕwt <sup>ʕ</sup>	<i>ʕa:jit<sup>ʕ</sup></i>	<i>ʕajt<sup>ʕ</sup>a</i>	‘kicking’	<i>ʕoot<sup>ʕ</sup>a</i>	‘kick N’
dwr	<i>da:jir</i>	<i>dajra</i>	‘turning’	<i>doora</i>	‘restroom’
njm	<i>na:jim</i>	<i>najma</i>	‘sleeping’	<i>nooma</i>	‘sleep fit’
xjf	<i>xa:jif</i>	<i>xajfa</i>	‘afraid’	<i>xoof</i>	‘fear’

<sup>8</sup> Old Arabic participles from hollow roots are characterized by the loss of intervocalic glides which are replaced by glottal stops, e.g., *xa:ʔib* ‘hopeless MS’, *ba:ʔiʕah* ‘selling FS’, etc. The corresponding participles in CA surface invariably with /j/, even in roots with a medial /w/. This is a result of a widespread historical paradigm convergence (§5.2.2.4). However, the sequence Ca:WiC is permitted on the surface in measure III verbs, which have the same pattern as the participle, e.g., *ga:wib* ‘he answered’, *ħa:wil* ‘he attempted’, etc (Broselow 1976:168).

The alternations in (18) show nouns or verbs of the pattern Ca:GiC in the base (third person) masculine singular. Attachment of a vowel-initial suffix results in deletion of the /i/ nucleus (and consequent re-syllabification of the onset glide to the coda of the preceding syllable) and shortening of the long vowel /a:/. The diphthongs, therefore, are derived in a similar way to the feminine singular participles above—as will be explained in §5.2.3. (Consider also the nouns: *dajman* ‘always’ and *malajka* ‘angels’).

## (18) Diphthongs in inflected nouns and verbs

<i>fa:jib</i>	‘king of cards’	+ - <i>een</i>	DUAL	→	<i>faj.been</i>	‘two kings of cards’
<i>xa:jib</i>	‘loser’	+ - <i>in</i>	PL	→	<i>xaj.bi:n</i>	‘losers’
<i>za:jid</i>	‘he bid’	+ - <i>a</i>	N	→	<i>mu.zaj.da</i>	‘auction’
<i>ʔa:wih</i>	‘he wrangled’	+ - <i>a</i>	N	→	<i>mi.ʔaw.ha</i>	‘wrangling’
<i>dajjiʔ</i>	‘he harassed’	+ - <i>it</i>	FS	→	<i>daj.ʔit</i>	‘she harassed’
<i>ħa:wil</i>	‘he tried’	+ - <i>it</i>	FS	→	<i>ħaw.lit</i>	‘she tried’
<i>ʕajir</i>	‘he taunted’	+ - <i>u</i>	PL	→	<i>ʕaj.ru</i>	‘they taunted’
<i>ʔitʕa:win</i>	‘he cooperated’	+ - <i>u</i>	PL	→	<i>ʔit.ʕaw.nu</i>	‘they cooperated’

One case in which the alternations with a long vowel are not as straightforward is an adjectival derivative of hollow verbs that has the template CaGCa:n. This derivation is very common and productive in Cairene, while much more restricted in OA. It is generally derived from intransitive verbs and indicates “the attaining of a state by the subject”. I will show in §5.2.3 that diphthongs in this morphological class are also phonologically derived through shortening of an underlying long vowel, and thus are not subject to monophthongization.

## (19) Diphthongs in CaGCa:n adjectival forms

<i>xajba:n</i>	‘good-for-nothing’	<i>najma:n</i>	‘sleepy’
<i>sajba:n</i>	‘loose’	<i>ħajrʕa:n</i>	‘perplexed’
<i>majla:n</i>	‘inclined’	<i>ʕajʔa:n</i>	‘dandified’
<i>hajga:n</i>	‘berserk/aroused’	<i>ħajʕa:n</i>	‘uproarious’
<i>ħajzʕa:n</i>	‘spoiled’	<i>majʕa:n</i>	‘pampered’
<i>fajxa:n</i>	‘old (vegetables)’	<i>ʕajrʕa:n</i>	‘jealous’
<i>xawja:n</i>	‘empty’	<i>zawrʕa:n</i>	‘choking’

## 5.2.2.4 Final-Weak Roots CCG

The final vowel of CA final-weak (defective) verbs is replaced by /ee/ before the addition of subject pronominal suffixes. The unexpected lack of a corresponding /oo/ in this category 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).<sup>9</sup>

<sup>9</sup> Doubled verbs also have an allomorph ending in /ee/ before consonant-initial inflection suffixes (Broselow 1976:160). This is surprising because, unlike final-weak verbs, doubled verbs do not have an underlying glide. Given the lack of direct evidence, learners will resort to the free ride algorithm.

The underlying glide was not realized due to a constraint on stem-final diphthongs (Watson 2002:145), and the //ai// sequence was subject to coalescence into /ee/ (Abu-Mansour 1992:67, Gadalla 2000:69). As exemplified in (20a), most verbs with a long mid vowel /ee/ have morphologically some related nouns that display the glide /j/ and occasionally /w/. This and the analogous sound roots in (20b) provide evidence that monophthongization in these verbs is a fact of the synchronic grammar.

## (20) Long mid vowels in verbs of final-weak roots

	<i>target</i>		<i>alternation</i>		√
a.	<i>ʔiʃtareet</i>	‘I bought’	<i>ʃarwa</i>	‘purchase’	ʃrj
	<i>ħakeena</i>	‘we told’	<i>ħika:ja</i>	‘affair’	ħkj
	<i>daʃeet</i>	‘you MS invited’	<i>daʃa:ja</i>	‘propaganda’	dʃw
	<i>waʃsʕeʕti</i>	‘you FS advised’	<i>taʃwsʕija</i>	‘advice’	wsʕj
	<i>ʔaʃtʕeʕtu</i>	‘you PL covered’	<i>ʔuʃtʕa:n</i>	‘covers’	ʔtʕj
	<i>naʔʔeet</i>	‘I picked’	<i>naʔa:wa</i>	‘selection’	nʔj
b.	<i>ʔikkabast</i>	‘I was shamed’	<i>kabsa</i>	‘embarrassment’	kbs
	<i>katabna</i>	‘we wrote’	<i>kita:ba</i>	‘writing’	ktb

On the other hand, nouns ending in the templatic pattern -Ca:Ga (derived from final-weak roots) exhibit a surface diphthong upon suffixation of vowel-initial possessive pronouns. As shown in (21a–b), these feminine nouns are always in their construct state (with a final /t/) before pronominal endings (Abdel-Massih et al. 1979:212). The diphthongs clearly result from shortening the long vowel /a:/, similar to examples in (17–19) above.

## (21) Diphthongs in CVCa:Ga nouns inflected for possession

a.	<i>da:ja</i>	‘midwife’	<i>daj-tak</i>	‘your MS midwife’
	<i>ħika:ja</i>	‘affair’	<i>ħikaj-ti</i>	‘my affair’
	<i>milaja</i>	‘bed sheet’	<i>milaj-tik</i>	‘your FS bed sheet’
	<i>nihaja</i>	‘end N’	<i>nihaj-tu</i>	‘his end’
b.	<i>naʔa:wa</i>	‘selection’	<i>naʔaw-ti</i>	‘my selection’
	<i>ʃaʔa:wa</i>	‘naughtiness’	<i>ʃaʔaw-tak</i>	‘you MS naughtiness’
	<i>ħala:wa</i>	‘sweetness’	<i>ħalaw-tik</i>	‘your FS sweetness’
	<i>ʔaba:wa</i>	‘stupidity’	<i>ʔabawa-tu</i>	‘his stupidity’

One last point here is that Cairene retains diphthongs in word-final open syllables (22a). This generalization is only based on a few lexical items because of historical final glide deletion, but there is reasonable ground to support it. For example, a long mid vowel /oo/ appears in *loola* ‘if not’ by suffixing a morpheme to *law* ‘if’, while this is not the case when a morpheme is prefixed as in *walaw* ‘even if’ (but see Broselow 1976:153). A related fact is the restriction of /a:j/ and /a:w/ diphthongs to word-final position, exemplified in (22b).

## (22) Diphthongs in word-final position

a.	<i>ʕaw</i>	(howling sound)	<i>naw</i>	(mewing sound)
	<i>ʕaw</i>	‘or’	<i>law</i>	‘if’
	<i>walaw</i>	‘even if’	<i>loola</i>	‘if not’
b.	<i>wa:w</i>	(Arabic letter)	<i>ga:j</i>	‘coming’
	<i>ʕa:j</i>	‘tea’	<i>na:j</i>	‘flute’
	<i>ʕizza:j</i>	‘how’	<i>ʕaβaɖʕa:j</i>	‘bully’
	<i>rayya:j</i>	‘chatterbox’	<i>ʕakkaj</i>	‘complainer’
	<i>nassa:j</i>	‘forgetful’	<i>garra:j</i>	‘fast runner’

## 5.2.2.5 Prepositions and Clitics

Parallel to the behavior of final-weak verbs, the preposition *ʕala* ‘on’ replaces its final /a/ vowel by /ee/ before object pronoun suffixes (Abdel-Massih et al. 1979:323), as shown in (23a). So, if we propose the underlying form //ʕalai//, then the allomorph *ʕalee-* is derived by monophthongization (Gadalla 2000:215). The geminated form *ʕalajja* ‘on me’ preserves the diphthong, as we would expect given (12) above. The form *ʕalee* ‘on him’, on the other hand, seems to violate the ban on word-final long mid vowels. However, it has long been assumed that the post-vocalic form of the third person masculine singular pronoun is underlyingly //h// (on analogy with other suffixes) that is deleted on the surface (Woidich 2006a:40). This is not only based on morphological and diachronic evidence, but also on the synchronic fact that there is no contrast in the language between a final long (stressed) vowel and a final long (stressed) vowel plus /h/ (Ferguson 1957:473). Furthermore, the final /h/ of the third person masculine singular suffix may optionally surface before an epenthetic vowel and in utterance-final position. This is also the case in loanwords where this so-called virtual /h/ exists in free variation (and in the Arabic spelling), as exemplified in (23b).

## (23) Long mid vowels in some non-verbal derivations

a.	<i>ʕalajja</i>	‘on me’	<i>ʕaleena</i>	‘on us’
	<i>ʕaleek</i>	‘on you MS’	<i>ʕaleeki</i>	‘on you FS’
	<i>ʕaleekum</i>	‘on you PL’	<i>ʕaleehum</i>	‘on them’
	<i>ʕalee(h)</i>	‘on him’	<i>ʕaleeha</i>	‘on her’
b.	<i>lee(h)</i>	‘why’	<i>ʕee(h)</i>	‘what’
	<i>bee(h)</i>	‘bey’	<i>ginee(h)</i>	‘Egyptian pound’
	<i>bukee(h)</i>	‘bouquet’	<i>bunee(h)</i>	‘bonnet’
	<i>filee(h)</i>	‘filet’	<i>ʕiffee(h)</i>	‘effect (cinema)’
	<i>balee(h)</i>	‘ballet’	<i>kabanee(h)</i>	‘toilet’

One last note concerns the dual marker *-een*, as in *walad-een* ‘two boys’ and *fallaħt-eeen* ‘two farmers (F)’. Native speakers can recover the underlying form //ain// on the basis of analogy, assuming that it undergoes monophthongization.

### 5.2.2.6 Interim Generalizations

In the previous sections we have seen strong evidence that underlying //ai// and //au// become /ee/ and /oo/ in CA. This process of monophthongization takes place within any morpheme including a suffix, and regardless of stem position or stress. However, it is blocked from applying in six contexts: (i) in morphologically derived environments, i.e., where diphthongs are formed across two adjacent morphemes (6, 7); (ii) when the diphthong is phonologically derived through earlier processes (17–19); (iii) when the low vowel of the diphthong is followed by a geminate glide (12); (iv) to avoid a long mid vowel in word-final position (22); (v) in verbs and nouns derived from quadrilateral roots (13); and (vi) in a handful of foreign and Standard Arabic loans that preserve the diphthong morpheme-internally (14–15).

The contexts in which monophthongization is blocked have led to claims in the literature that this process is no longer synchronically relevant and that “exceptions” to monophthongization testify to the existence of underlyingly (long) mid vowels. Nonetheless, 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.

### 5.2.3 Features and Representations in CA Monophthongization

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

#### 5.2.3.1 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 (24).

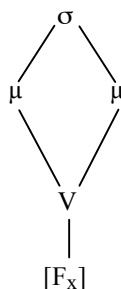
(24) Sources of Syllable Weight

- 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).

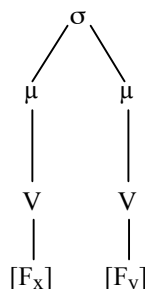
There are six logical possibilities for combining moras, root nodes, and features that will be explored here. The most common discussions include the representations in (25). (25a) is a *true* long vowel with two moras associated to a single root node that

has a particular feature. (25b) 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 (25c).

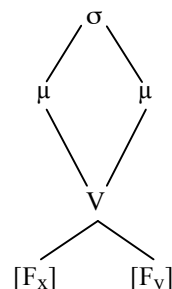
(25) a. True Long Vowel



b. Diphthong

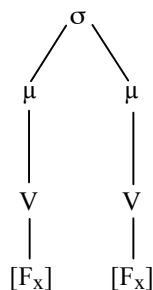


c. True Long Vowel

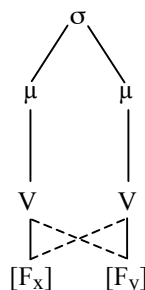


Three other logical possibilities are illustrated in (26). (26a) is a *false* long vowel composed of two root nodes associated with different moras and different tokens of the same feature; (26b) is a false long vowel composed of two root nodes associated with different moras but the same tokens of multiple features; and (26c) 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.

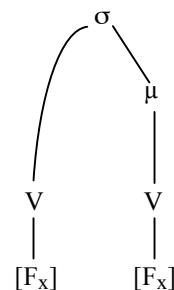
(26) a. False Long Vowel



b. False Long Vowel



c. Glide-High V Sequence



The structural difference between true long vowels of the type given in (25a) and false long vowels of the type given in (26b) 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 (the Richness of the Base principle) captures vowel length distinctively via underlying bimoraicity along with a particular ranking of faithfulness and markedness constraints on moraicity. That is, underlyingly bimoraic vowels do not lose their bimoraicity unless some high-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, Richness of the Base requires that we



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 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 (26b) type on the surface due to feature assimilation (rather than mere coalescence as in (25c)). 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 (25a) or a false long vowel with two root nodes and the same tokens of multiple features (26a). 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. (25a), 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 (26c) 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/.

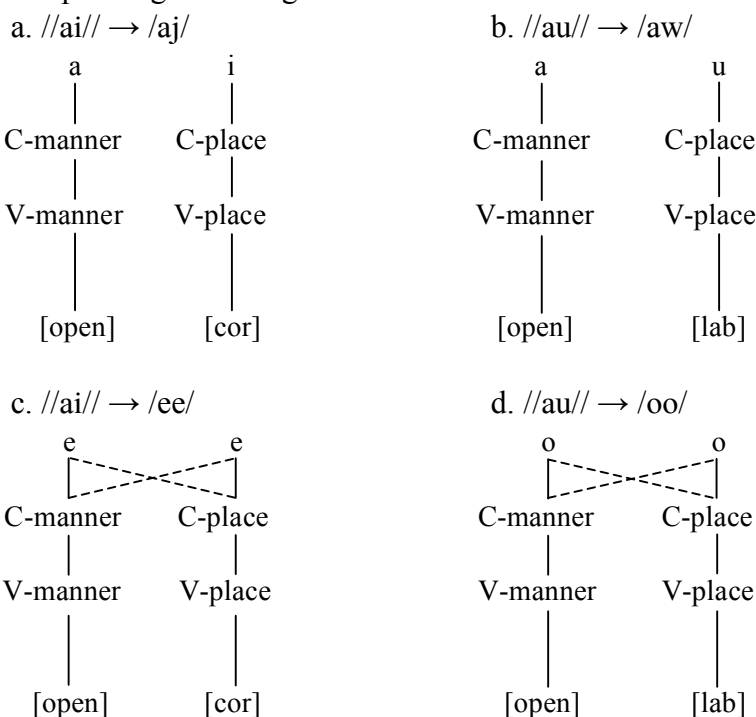
### 5.2.3.2 Autosegmental Representations

In section 4.2.2, I argued for a V-manner[open] feature specification of the front low vowel /a/. We should recall that high vowels and glides are featurally identical in CA, and the syllabic position determines which form surfaces (Watson 2002:47).<sup>10</sup> Hence, the labial glide /w/ and the corresponding round vowel /u/ are both specified for the feature V-place[lab], while the palatal glide /j/ and the corresponding front vowel /i/ are specified for V-place[cor]. Vowel height itself—presumably a manner feature—is not contrastive in Cairene.

The generalizations made in §5.2.2 confirm that long mid vowels result from full feature assimilation of particular underlying vowel sequences in particular morphological environments. Sometimes these sequences surface faithfully (i.e., as diphthongs) and sometimes they result in long mid vowels, but without disturbing the precedence relations of the constituent elements. We infer that CA diphthongs and long mid vowels have identical featural composition; namely, that both have the features for a low and a high vowel, as illustrated in (27a–b) and (27c–d), respectively.

<sup>10</sup> A fact that confirms this assertion is that /ij/ never contrasts with /i:/, and /uw/ never contrasts with /u:/ in CA (Harrell 1957:66).

## (27) CA diphthongs and long mid vowels



It must be noted that these specifications are similar in both intuition and formulation to Watson's (2002:47–8) representations of CA vowels: /a/ as primary guttural, /i/ as primary and non-primary [dor], /u/ as primary [dor] and 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.

## 5.2.3.3 Phonological Strategies

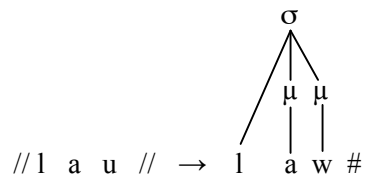
The previous subsections have described the formation of long mid vowels in CA as assimilation. CA assimilates all diphthongs into long mid vowels regardless of stem position or stress. To handle this representationally, a long mid vowel, as in *loon* 'color', is underlyingly composed of a low and a 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 (28).

## (28) CA Monophthongization

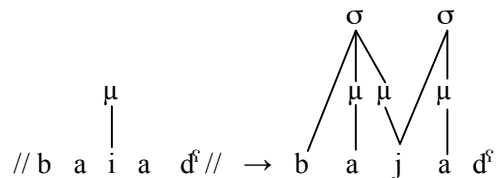


Diphthong assimilation does not apply in certain environments. In morphologically derived environments—when the two vowels of a diphthong span two morphemes—they fail to assimilate in order to preserve morpheme identity (see §5.2.4). Moreover, diphthongs in word-final open syllables are protected by virtue of their position (29a). 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, an effect known *geminate inalterability* (Hayes 1986a). Since the only vowel-initial syllables allowed in CA begin with high vowels in the phonetic form of glides, monophthongization—viz., the creation of false long mid vowels from diphthongs—is blocked in environments where the surface mid vowel would be syllabified as an onset (29b). This accounts for the lack of coalescence involving medial geminates. Word-final glide geminates resist assimilation, not because they are linked to an onset, but because of their position.

(29) a. Word-final position



b. Geminate Diphthongs



Section 5.2.2.3 showed that Cairene preserves diphthongs in specific morphological contexts that 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 suffixing *-a* to the masculine forms. To figure out the underlying representation for this morphological paradigm, it is useful to first consider the masculine singular participle for a root without weak radicals. An example is *sakit* ‘maintaining silence MS’ from  $\sqrt{\text{skt}}$ , with Ca:CiC underlying templatic structure. To derive the feminine participle, *-a* is suffixed to the cognate masculine form, i.e., //sakit-a//, after which the prosodic strategies in (30) produce the surface form *sakta*.

(30) a. CA Syncope

// i, u // →  $\emptyset$  / CV. C — .CV(C)

b. CA Closed-Syllable Shortening

(V)V: → (V)V / — C $_{\sigma}$  CV

The first strategy (30a) states that a non-final unstressed //i// or //u// is elided in an open syllable after another open syllable (Broselow 1992:33, Kenstowicz 1980:42). 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 (30b) states that a non-final long vowel is shortened in a closed syllable (Abdel-Massih et al. 1979:318) to

avoid word-medial non-moraic codas (Watson 2002:66). Since the language does not allow CV:C 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 closed-syllable shortening and syncope can be seen as strategies to avoid violation of a “bimoraicity constraint” (Broselow 1992:10), which dictates that “syllables are maximally and optimally bimoraic”. Syncope, therefore, applies in Cairene to minimize vulnerable monomoraic syllables (*ibid.*, p.35) and closed-syllable shortening applies to eliminate illicit trimoraic syllables (Abu-Mansour 1992:53). But CV:G sequences are tolerated in word-final position where the final glide (or consonant otherwise) has been argued to be extrametrical (*ibid.*). This explains the restriction of the highly marked /aj/ and /a:w/ diphthongs to this position, as in (22b).

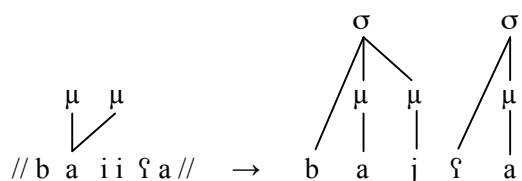
The feminine participle surface form *sakta* from the sound root  $\sqrt{\text{skt}}$  can now be derived in a rule ordering account as in (31), based on Abu-Mansour (1992:72–3). Forms with a weak medial radical in their root have the same underlying representation, with /j/ replacing C<sub>2</sub> after onset formation. The derivation for *bajʕa* ‘selling FS’ from  $\sqrt{\text{bjʕ}}$  can be derived in the same fashion as for *sakta*.

(31) Deriving feminine active participles in sound and hollow roots

//sa:ki <sub>σ</sub> ta <sub>σ</sub> //	Underlying Representation	//ba:iiʕ-a//
sa:ki <sub>σ</sub> ta <sub>σ</sub>	Onset Formation	ba:ji <sub>σ</sub> ʕa <sub>σ</sub>
sa:k <sub>σ</sub> ta <sub>σ</sub>	Syncope	ba:j <sub>σ</sub> ʕa <sub>σ</sub>
sa:k <sub>σ</sub> ta <sub>σ</sub>	Coda Formation	ba:j <sub>σ</sub> ʕa <sub>σ</sub>
sak <sub>σ</sub> ta <sub>σ</sub>	Closed Syllable Shortening	baj <sub>σ</sub> ʕa <sub>σ</sub>
<span style="border: 1px solid black; padding: 2px;">sakta</span>	Surface Representation	<span style="border: 1px solid black; padding: 2px;">bajʕa</span>

One should, therefore, consider the feminine active participle as having //Ca:CiCa// underlying templatic structure (see Farwaneh 2009:91–2). 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 to say, monophthongization does not apply to forms such as *bajʕa* because /aj/ is phonologically derived as a result of syncope and closed syllable shortening, as illustrated in (32). This can also be understood as an attempt to remain as faithful to the base (masculine) form as possible. The same generalizations pertain to all cases in (18) and (21).

(32) A derived diphthong in feminine active participles



Another context in which Cairene preserves diphthongs morpheme-internally is the adjectival derivative of hollow verbs, which takes the template CaGCa:n. While the CaCCa:n form is used as the only active participle for a number of stative measure I verbs (Woidich 2006a:84), most speakers use it alongside the Ca:GiC active participle to indicate a state attained by the doer of the action. I propose that CaCCa:n adjectival forms are derived from a base Ca:GiC through the addition of the suffix *-a:n* and subsequent phonological changes (but see Watson 2002:156–7). Hence, the derivation of surface CaGCa:n from underlying //Ca:GiC-a:n// is reached in the same way as the feminine participle forms through syncope and closed syllable shortening, as shown in (33). The appearance of the diphthong is therefore attributed to the shortening of an underlying long vowel, and the phonologically derived diphthong escapes monophthongization (by being faithful to the base). The fact that all CA productive forms in (19) have an active participle with a long vowel provides independent evidence for the current proposal.

## (33) Deriving CaGCa:n adjectives

//na:iim-a:n//	Underlying representation
na:⊘ji⊘ma:n⊘	Onset Formation
na:⊘j⊘ma:n⊘	Syncope
na:j⊘ma:n⊘	Coda Formation
naj⊘ma:n⊘	Closed Syllable Shortening
najma:n	Surface Representation

To summarize, monophthongization in CA is a case of an understudied phenomenon known as Derived Environment Blocking (henceforth DEB) in which a surface structure is excluded when it is morphologically or phonologically derived, but allowed when it is nonderived (Hall 2006).<sup>11</sup> Examples like (7b) even show that a diphthong can be derived morphologically (across a word boundary) and phonologically (after syncope) at the same time. In this section, I have shown how DEB can be explained through derivations. However, in a model that has no such notion, DEB can be more challenging.

## 5.2.4 Constraints and Monophthongization in CA

This section proposes an analysis to CA monophthongization as DEB by accounting for the diphthong/monophthong surface forms in classic Optimality Theory. 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 that refer to the syllable rime interact with faithfulness constraints against feature

<sup>11</sup> This is the mirror image of the widely known Derived Environment Effects (see e.g., Kiparsky 1993, Łubowicz 2002, Anttila 2009) in which phonological processes apply only in derived environments (morphological and phonological), but are blocked elsewhere.

insertion and with more specific faithfulness constraints against associating features to a new morpheme, to a following onset, or in word-final position.

In §5.2.3, I claimed that long mid vowels result from full feature assimilation of particular underlying vowel sequences in particular morpho-phonological contexts. Sometimes these sequences surface faithfully and sometimes they result in false long vowels. In order to account for this assimilation, I propose the alignment markedness constraint in (34a), which aligns the feature V-manner[open] (= //a//) to the right edge of the rime, and two other constraints that align V-place[lab] (= //u//) or V-place[cor] (= //i//) to the left edge of the rime (34b–c). These are unranked with respect to one another, but ranked with respect to DEPLINK [F] in (34d). The latter is shorthand for a conjunction of three DEPLINK constraints against linking V-manner[open] and V-place[lab/cor] to segments that are not linked in the input; i.e., it penalizes the structures in (26b) in favor of (25b).

- (34) a. R-ALIGN V-[open]: Align a V-manner[open] feature to the right edge of the rime.  
 b. L-ALIGN V-[lab]: Align a V-place[lab] feature to the left edge of the rime.  
 c. L-ALIGN V-[cor]: Align a V-place[cor] feature to the left edge of the rime.  
 d. DEPLINK [F]: Do not associate any of the features V-manner[open] and V-place[lab/cor] to a segment that did not have it underlyingly.

Setting aside the exceptional cases for the moment, underlying diphthongs systematically become long mid vowels on the surface. In OT terms, the diphthongs are less harmonic than mid vowels. This implies that alignment constraints are ranked higher than faithfulness constraints, as shown in Tableau (35).

- (35) R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	//daiŋ//	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
a.		*!	*!	
☞ b.				**

Recall that diphthongs are preserved across a morpheme boundary. Since the alignment constraints in (34) would be violated by the optimal output, they must be outranked by faithfulness constraints that make reference to morphology. There are a number of possible ways to formulate such constraints. But since a full discussion of morphologically relativized faithfulness constraints is beyond the scope of this study,

and in keeping with (34d), I suggest the constraint  $\text{DEPLINK}/\text{MORPH}^1$  in (36). Ranking this constraint above  $\text{ALIGNMENT}$  predicts that no assimilation will take place cross-morphemically, as illustrated in Tableau (37).

(36)  $\text{DEPLINK} [\text{F}]/\text{MORPH}^1$ : Do not associate any of the features  $\text{V-manner}[\text{open}]$  and  $\text{V-place}[\text{lab}/\text{cor}]$  to a morpheme that did not have it underlyingly.

(37)  $\text{DEPLINK} [\text{F}]/\text{MORPH}^1 \gg \text{R-ALIGN V-}[\text{open}], \text{L-ALIGN V-}[\text{lab}] \gg \text{DEPLINK} [\text{F}]$

	//ʔa-ufa <sup>u</sup> n//	$\text{DEPLINK} [\text{F}]/\text{MORPH}^1$	$\text{R-ALIGN V-}[\text{open}]$	$\text{L-ALIGN V-}[\text{lab}]$	$\text{DEPLINK} [\text{F}]$
a.	ʔa <sup>u</sup> -w <sup>u</sup> ] <sub>σ</sub> fa <sup>u</sup> n] <sub>σ</sub>		*	*	
b.	ʔo <sup>u</sup> -o <sup>u</sup> ] <sub>σ</sub> fa <sup>u</sup> n] <sub>σ</sub>	*!*			**

To account for the resistance of verbs and nouns of quadrilateral roots to undergo monophthongization, I resort to the notion of morphologically co-indexed constraints. These are drawn from the universal set of constraints, but they apply only if they are co-indexed with the input. I formulate the lexically indexed  $\text{DEPLINK}$  constraint in (38) (see also Pater 2000, Jurgec 2010b).

(38)  $\text{DEPLINK} [\text{F}]_{\text{QUADRI}}$ : Assign a violation mark to any instance of  $\text{DEPLINK} [\text{F}]$  that contains a phonological exponent of a morpheme derived from a quadrilateral root.

Tableau (39) shows that a high ranking  $\text{DEPLINK} [\text{F}]_{\text{QUADRI}}$  guarantees that all morphemes derived from quadrilateral roots will escape assimilation to mid vowels. In cases where there is no matching indexation in the input, then  $\text{DEPLINK} [\text{F}]_{\text{QUADRI}}$  is vacuously satisfied (see Finley 2010).

(39)  $\text{DEPLINK} [\text{F}]_{\text{QUADRI}} \gg \text{R-ALIGN V-}[\text{open}], \text{L-ALIGN V-}[\text{lab}] \gg \text{DEPLINK} [\text{F}]$

	//tawʔam // <sub>QUADRI</sub>	$\text{DEPLINK} [\text{F}]_{\text{QUADRI}}$	$\text{R-ALIGN V-}[\text{open}]$	$\text{L-ALIGN V-}[\text{lab}]$	$\text{DEPLINK} [\text{F}]$
a.	ta <sup>u</sup> -w <sup>u</sup> ] <sub>σ</sub> ʔa <sup>u</sup> m] <sub>σ</sub>		*	*	
b.	to <sup>u</sup> -o <sup>u</sup> ] <sub>σ</sub> ʔa <sup>u</sup> m] <sub>σ</sub>	*!*			**

Restrictions on assimilation in particular contexts can be captured through positional faithfulness constraints (Beckman 1998), grounded in the phonetic observation that many contrasts are perceptually more salient in certain contexts, such as word-initial and onset positions. Hence to account for the lack of monophthongization in word-final position, I propose the constraint in (40) against spreading  $\text{V-manner}[\text{open}]$  to a word-final segment. As illustrated in Tableau (41), a violation of the undominated  $\text{DEPLINK V-}[\text{open}]\#$  is sufficient to rule out the candidate with a long mid vowel /oo/.

(40) DEPLINK V-[open]#: Do not associate a V-manner[open] feature to a word-final segment that did not have it underlyingly.

(41) DEPLINK V-[open]# >> R-ALIGN V-[open], L-ALIGN V-[lab] >> DEPLINK [F]

	//lau//	DEPLINK V-[open]#	R-ALIGN V-[open]	L-ALIGN V-[lab]	DEPLINK [F]
a.			*	*	
b.		*!			**

Assimilation is also blocked when a true geminate is involved. This requires another undominated positional faithfulness constraint against spreading V-manner[open] to an onset (42). DEPLINK V-[open]/ONSET rules out candidate (43b) in the subsequent tableau. For simplicity, I do not include a high-ranking constraint that prevents splitting a geminate into two segments, only one of which undergoes assimilation (e.g., *bejad*).

(42) DEPLINK V-[open]/ONSET: Do not associate a V-manner[open] feature to an onset segment that did not have it underlyingly.

(43) DEPLINK V-[open]/ONSET >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	//bai <sup>u</sup> ad <sup>u</sup> //	DEPLINK V-[open]/ONSET	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
a.			*	*	
b.		*!			**

Recall that the feminine active participles have //Ca:Ca// as underlying templatic structure, and on the surface they undergo vowel syncope and closed syllable shortening. The key ingredients for high vowel syncope are standard markedness constraints against high vowels in the nucleus. Since we have only considered instances of /i/ syncope, it would be sufficient to formulate the constraint \*NUC/i in (44a). Although syncope applies only in “two-sided open syllables” and high vowels are allowed to surface otherwise, no special constraint against short high vowels in open syllables is necessary (Gouskova 2003:218). Thus to make the right predictions, \*NUC/i must be crucially dominated by the higher-ranking syllable structure, stress assignment, and



faithfulness constraints (cf. Walker 2005:974). For example, syncope is blocked if it results in an illicit trimoraic syllable by means of the constraint in (44b). Likewise, high vowels are not deleted in initial syllables because they result in illicit complex onsets. Following Gouskova (2003), I will conflate this and other remaining requirements into a single cover constraint PHONOTACTICS, since they are all inviolable in CA and do not interact with each other.

- (44) a. \*NUC/i: A monomoraic segment composed of just a V-place[cor] feature should not be in the nucleus.  
 b. \* $\mu\mu\mu$ : no tri-moraic syllable is allowed.

Of relevance also is the faithfulness constraint MAX V-[cor] in (45a). This constraint is violated each time an underlying /i/ vowel syncopates—hence, feature deletion. Closed-syllable vowel shortening implies violation of MAXLINK [ $\mu$ ] (Morén 1999: 39), formulated in (45b). Recall from the discussion in §5.2.3.1 that mora deletion can only be associated with true long vowels (25a), and that root node deletion is associated with a sequence of two identical vowels (26a).

- (45) a. MAX V-[cor]: Every V-place[cor] in the input has a correspondent V-place [cor] in the output.  
 b. MAXLINK [ $\mu$ ]: If a segment has a mora in the input, it should also have a mora in the output.

Tableau (46) shows the relative ranking of the last four constraints. I have discussed why \* $\mu\mu\mu$  and PHONOTACTICS dominate \*NUC/i. This ranking rules out candidate (46a). On the other hand, the fact that vowels syncopate at all suggests that \*NUC/i dominates MAX V-[cor] (Gouskova 2003:229). This eliminates outputs (46b) and (46c), which retain an /i/ nucleus in their second syllable. Finally, MAXLINK [ $\mu$ ] must also be ranked lower than \*NUC/i in order for the correct output (46d) to surface.

- (46) \* $\mu\mu\mu$  >> \*NUC/i >> MAX V-[cor] , MAXLINK [ $\mu$ ]

	//ba <sup>μ</sup> iɿ-a//	* $\mu\mu\mu$	*NUC/i	MAX V-[cor]	MAXLINK [ $\mu$ ]
a.	ba <sup>μ</sup> j <sup>μ</sup> ] <sub>σ</sub> ɿa <sup>μ</sup> ] <sub>σ</sub>	*!		*	
b.	ba <sup>μ</sup> ] <sub>σ</sub> j <sup>μ</sup> ] <sub>σ</sub> ɿa <sup>μ</sup> ] <sub>σ</sub>		*!		
c.	ba <sup>μ</sup> ] <sub>σ</sub> j <sup>μ</sup> ] <sub>σ</sub> ɿa <sup>μ</sup> ] <sub>σ</sub>		*!		*
☞ d.	ba <sup>μ</sup> j <sup>μ</sup> ] <sub>σ</sub> ɿa <sup>μ</sup> ] <sub>σ</sub>			*	*

In order to ensure that an input //ai// becomes /ee/ (in the general pattern), rather than an output where the underlying //i// element is deleted, MAX V-[cor] must outrank ALIGNMENT. But once we incorporate alignment constraints into the above tableau, we encounter a problem. We may recall that monophthongization is blocked when the

diphthong is phonologically derived, which is easily explained through derivations. However, in a theory that does not have this notion, the wrong output is predicted under the full ranking in (47). The real output (47d) loses because it contains a diphthong that does not undergo assimilation.

- (47) \* $\mu\mu\mu$  >> \*NUC/i >> MAX V-[cor], MAXLINK [ $\mu$ ] >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	//ba <sup>μ</sup> ii <sup>μ</sup> -a//	* $\mu\mu\mu$	*NUC/i	MAX V-[cor]	MAXLINK [ $\mu$ ]	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
a.	ba <sup>μ</sup> j <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub>	*!		*		*	*	
b.	ba <sup>μ</sup> qj <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub>		*!					
c.	ba <sup>μ</sup> qj <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub>		*!		*			
⊖ d.	ba <sup>μ</sup> j <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub>			*	*	*!	*!	
☛ e.	be <sup>μ</sup> e <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub>			*	*			*

Within OT, a number of constraint schemas have been proposed to account for this kind of opacity effects. One such schema is Optimal Paradigms (McCarthy 2005a), which has been used earlier in §3.2.4. In case of the feminine active participle, the immunity of a phonologically derived diphthong against assimilation can be straightforwardly justified by reference to the masculine form. I suggest a general OP-DEPLINK [F] constraint, formulated in (48), that applies to all parallel cases of paradigm uniformity (example sets (17–19) and (21)).

- (48) OP-DEPLINK [F]: Assign a violation mark to any instance of DEPLINK [F] in a morpheme whose output base form satisfies DEPLINK [F].

Tableau (49) shows that OP-DEPLINK [F] must dominate ALIGNMENT to rule out the monophthongizing candidate in (49b). The feminine output remains faithful to the base (masculine) form because it does not assimilate the pertinent features in the rime to produce a long mid vowel. In other words, it keeps the identity of the vowel-glide sequence of the base.

- (49) OP-DEPLINK [F] >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	//ba <sup>μ</sup> ii <sup>μ</sup> , ba <sup>μ</sup> ii <sup>μ</sup> -a//	OP-DEP LINK [F]	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
☞ a.	<ba <sup>μ</sup> qj <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub> , ba <sup>μ</sup> j <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub> >		*	*	
b.	<ba <sup>μ</sup> qj <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub> , be <sup>μ</sup> e <sup>μ</sup> σ <sub>σ</sub> ʔa <sup>μ</sup> σ <sub>σ</sub> >	*!			*

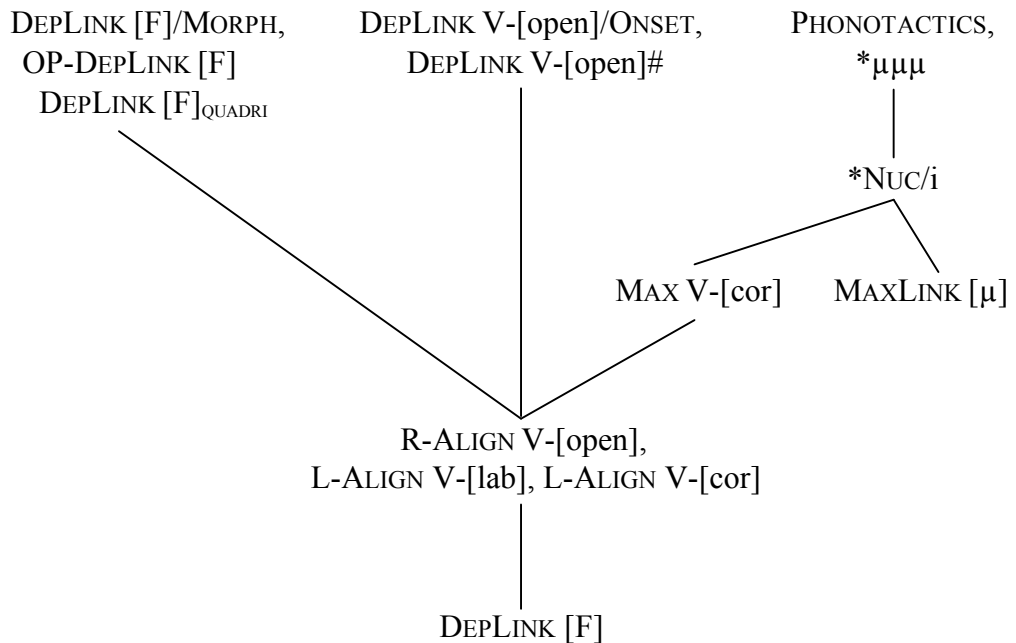
The fact that *bajfa* ‘selling FS’ alternates with *beefa* ‘sale’ can now be explained in Tableau (50). Because *beefa* (from underlying //baiʔa//) belongs to a different paradigm whose base form undergoes monophthongization, the constraint OP-DEPLINK [F] is vacuously satisfied. On the other hand, ALIGNMENT violations are fatal.

(50) OP-DEPLINK [F] >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	// baiʔ, baiʔ-a //	OP-DEP LINK [F]	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
a.	< be <sup>h</sup> e <sup>h</sup> ʔ <sub>σ</sub> , ba <sup>h</sup> j <sup>h</sup> <sub>σ</sub> ʔa <sup>h</sup> <sub>σ</sub> >		*!	*!	
b.	< be <sup>h</sup> e <sup>h</sup> ʔ <sub>σ</sub> , be <sup>h</sup> e <sup>h</sup> <sub>σ</sub> ʔa <sup>h</sup> <sub>σ</sub> >				*

The full ranking for Cairene monophthongization is summarized in diagram (51). In general, alignment constraints dominate DEPLINK [F], and they are in turn dominated by more specific (positional or other) faithfulness constraints.

(51) Constraint rankings for CA monophthongization



### 5.3 Monophthongization in Baghdadi Arabic

Like most modern Arabic dialects, Baghdadi Arabic mid vowels /ee/ and /oo/ have developed from Old Arabic diphthongs /aj/ and /aw/, respectively (Oussani 1901:103, Altoma 1969:22). And just like in Cairene, the appearance of both surface diphthongs and new non-alternating long mid vowels has led to claims that long mid vowels are underlying in Baghdadi and that monophthongization no longer applies. The detailed investigation and subsequent discussion in this section provide compelling evidence to the contrary. Three observations in particular suggest that all mid vowels are synchronically derived from a diphthongal source: (i) the absence of short mid vowel phonemes; (ii) the systematic complementary distribution of mid vowels and diphthongs; and (iii) the alternation of the verbal suffix *-aw* /*-oo* in final versus non-final position. The main argument is that monophthongization applies across the board and that the distribution of surface diphthongs is systematic and predictable.

The remainder of this section is organized as follows. Section 5.3.1 introduces the surface inventory of BA monophthongs, and argues that short mid vowels are not contrastive. Section 5.3.2 explores the morphological environments in which mid vowels and diphthongs appear in BA. As in CA, the relevant contrasts are discussed under their respective type of weak root. Section 5.3.3 briefly considers the featural and moraic representations of BA long mid vowels and diphthongs, and then moves on to examine monophthongization and other related phonological processes in a derivational theory of grammar. Section 5.3.4 formulates these complex phonological interactions in a non-derivational theory (OT).

#### 5.3.1 Surface Monophthongs in BA

Baghdadi Arabic vowel inventory is identical to that of CA. It has four short vowels /i, u, a, ʌ/ and six long vowels /i:, u:, a:, ʌ:, ee, oo/. The long mid vowels /ee/ and /oo/ do contrast with both long-high and long-low vowels and with each other (52a–c).

##### (52) Contrasts involving long mid vowel

a.	<i>ʔeeb</i>	‘pocket’	<i>ʔi:b</i>	‘bring! MS’
	<i>gees</i>	‘touching’	<i>gi:s</i>	‘measure! MS’
	<i>ʃoof</i>	‘seeing’	<i>ʃu:f</i>	‘see! MS’
	<i>koon</i>	‘quarrel’	<i>ku:n</i>	‘be! MS’
b.	<i>seef</i>	‘touching’	<i>sa:f</i>	‘it rubbed off’
	<i>ʃeen</i>	‘eye’	<i>ʃa:n</i>	‘he helped’
	<i>noom</i>	‘sleeping’	<i>na:m</i>	‘he slept’
	<i>ðook</i>	‘those’	<i>ða:k</i>	‘he tasted’
c.	<i>meez</i>	‘table’	<i>mooz</i>	‘bananas’
	<i>deer</i>	‘monastery’	<i>door</i>	‘turn N’

Unlike CA, Baghdadi allows more than one long vowel in the phonological word. Thus the long vowels /i:, u:, a:, ɑ:, ee, oo/ are allowed in both stressed and unstressed syllables (Blanc 1964:33–4), and they may be followed by one or no consonants, but never by two (see Abu-Haidar 2006:225). The four short vowels /i, u, a, ɑ/ may also be in stressed, pre-stress, or post-stress position, and may be followed by one or no consonants. Final clusters (in CVCC syllables) are separated by an epenthetic vowel with very few exceptions.

BA long mid vowels /ee/ and /oo/ are mainly characterized as phonologically distinctive, while there is disagreement as to the status of the short mid vowels /e/ and /o/, which have been treated as phonemic or allophonic in the literature. In fact, BA short /e/ and /o/ may be regarded as mere phonetic variants of originally short /i/ and /u/ for the same reasons outlined in CA. Even those BA grammars that include short mid vowels—e.g., Erwin 1963, Malaika 1963—maintain that neither /ee/ nor /oo/ has correspondingly short phonemic parallels, although they each have shorter phonetic variants.<sup>12</sup> Second, minimal pairs contrasting /i/–/e/ or /u/–/o/ do not seem to exist (Altoma 1969:20).

Speakers of Baghdadi rarely show an auditory /i/–/e/ distinction in word-medial position. Abu-Haidar (2006) claims that a phonemic /i/ is restricted to unstressed open syllables, especially in word-final position. This is because only in final position does a short /i/ retain the tense quality of long [i:]; otherwise, it is a lower and more retracted [ɪ] (Erwin 1969:17). The correct prediction of this complementary distribution is that [ɪ] and [e] are phonetic allophones of an /i/ phoneme (Cowan 1966:697). On the other hand, a phonemic /o/ is claimed to occur in a very limited number of loans, mainly word-finally (Erwin 1963:20), but also in medial position (Alkalesi 2001). Since short /u/ in BA is often realized as a lowered lax [ʊ], the acoustic values of short /u/ and /o/ overlap significantly, and one can safely claim that native speakers use some phonetic variant of /u/ in these words, rather than a phonemic /o/. Some examples are given in (53).

(53) BA words containing short /u/ (typically transcribed /o/)

<i>ra:dju</i>	‘radio’	<i>ra:djuwa:t</i>	‘radios’
<i>ga:zi:nu</i>	‘casino’	<i>ga:zi:nuwa:t</i>	‘casinos’
<i>ba:nju</i>	‘bathtub’	<i>ma:ju</i>	‘bathing suit’
<i>ba:sburt</i>	‘passport’	<i>bustkart</i>	‘postcard’
<i>pja:nu</i>	‘piano’	<i>tʃmi:ntu</i>	‘cement’

The chart in (54) summarizes the surface monophthongs in BA (which are identical to CA).

<sup>12</sup> Abu-Haidar (2006) includes a schwa /ə/ rather than short /e/ phoneme. Blanc (1964:30) claims that /e/ was used only for convenience to represent a phoneme with allophones clustering around a mid central schwa; and that a phonemic /ə/ would have been preferable.

(54) Chart: surface vowel monophthongs in BA

	Front	Back
High	i(:)	u(:)
Mid	ee	oo
Low	a(:)	ɑ(:)

### 5.3.2 The Distribution of Monophthongs and Diphthongs in BA

The BA vowel system lacks short mid vowels, while both low and high vowels alternate between long and short. As argued earlier, if all long mid vowels are derived by assimilation, there would be no source for short mid vowels (McCarthy 2005b:22). Like most dialects of Arabic, BA long mid vowels have a diphthongal (vowel plus glide) source in Old Arabic (Oussani 1901, Malaika 1963, Jastrow 1980, *inter alia*).<sup>13</sup> This is schematized as follows.

(55)	<i>OA</i>	<i>example</i>	<i>BA</i>	<i>example</i>	<i>gloss</i>
	/aj/	<i>bajtajn</i>	→ /ee/	<i>beeten</i>	‘two houses’
	/aw/	<i>jawm</i>	→ /oo/	<i>joom</i>	‘day’

Baghdadi diphthongs /aj, aw/ [see also fn.4] appear instead of the expected /ee, oo/ in some contexts, leaving such nuclei identical to their OA correspondents. The environments are very similar to those in CA, but there are some interesting discrepancies. This section presents the morphological contexts in which diphthongs and long mid vowels surface in BA, following the same classification of lexical items according to the position of the weak radical in the root.

#### 5.3.2.1 Initial-Weak Roots GCC

Derivations of initial-weak roots retain the diphthongs /aj/ and /aw/ in the comparative adjectives (whether adjectives or names) (56a), requestive or estimative verbs (56b), passive participles (56c), and verbal nouns (56d). The broken plurals in (56e), on the other hand, have alternative forms and may be considered OA borrowings (Altoma 1969:24). The diphthongs in these classes arise from merging a prefix that ends in /a/ with a nominal stem that begins with a glide (Ferguson 1957:464).<sup>14</sup> Stress is irrelevant, and the diphthong may be stressed in some forms and unstressed in others.

<sup>13</sup> The long mid vowels in certain rural Iraqi dialects may be influenced by the so-called breaking, i.e., phonetic diphthongization towards on-glides. For example, *zeen* → [zje:n] ‘good’ and *leel* → [lje:l] ‘night’ (Cantineau 1960:104).

<sup>14</sup> Although CA and BA agree on the treatment of diphthongs in this environment, not all dialects of Arabic do the same. In Libyan Arabic, for instance, forms parallel to (56a) and (56c) are claimed to surface with a long mid vowel, e.g., *?oosaʕ* ‘larger’ and *moogaf* ‘parking’ (Abumdas 1985:163).

## (56) Diphthongs across morpheme boundaries (initial-weak radicals)

a.	<i>ʔa-wḏʔaḥ</i>	‘clearer’	<i>ʔa-wḏʔaḥ</i>	‘more valid’
	<i>ʔa-wḏaḳ</i>	‘more trusting’	<i>ʔa-wsʔaḥ</i>	‘middle’
	<i>ʔa-wfa</i>	‘more loyal’	<i>ʔa-wla</i>	‘more worthy’
	<i>ʔa-jham</i>	(male name)	<i>ʔa-jbas</i>	‘drier’
b.	<i>sta-wḥaḥ</i>	‘he felt lonely’	<i>sta-wriḥ</i>	‘he inherited’
	<i>sta-wla</i>	‘he seized control’	<i>sta-wḥaḥ</i>	‘he settled in’
	<i>sta-wḏʔab</i>	‘it deserved’	<i>sta-wzar</i>	‘he appointed as minister’
c.	<i>ma-wḏʔu:d</i>	‘present’	<i>ma-wlu:d</i>	‘born’
	<i>ma-wqu:f</i>	‘arrested’	<i>ma-wtur</i>	‘hostile’
	<i>ma-wkib</i>	‘procession’	<i>ma-wʔiḏʔa</i>	‘exhortation’
	<i>ma-jʔu:s</i>	‘hopeless’	<i>ma-jsu:r</i>	‘available’
d.	<i>ta-wqi:f</i>	‘signature’	<i>tawqi:f</i>	‘stopping’
	<i>ta-wfi:r</i>	‘saving’	<i>ta-wzi:f</i>	‘distributing’
	<i>ta-wḏʔi:f</i>	‘employing’	<i>ta-wsʔja</i>	‘commission’
	<i>ta-jsi:r</i>	‘facilitating’	<i>ta-jbi:s</i>	‘drying’
e.	<i>ʔa-wḥa:n</i>	‘home countries’	<i>ʔa-wra:m</i>	‘tumors’
	<i>ʔa-wra:d</i>	‘flowers’	<i>ʔa-wsa:x ~ zba:la</i>	‘dirt’
	<i>ʔa-wla:d ~ wulid</i>	‘sons’	<i>ʔa-jta:m ~ jta:ma</i>	‘orphans’

There are instances of /oo/ and /ee/ in this class where the original diphthong had disappeared in OA, providing evidence against the claim that all BA long mid vowels are historically derived from OA. This holds especially true for /oo/, which occurs in the imperfect of most /w/-initial verbs (Odden 1978:145), as shown in (57). Recall that certain parallel forms exhibit a diphthong /aw/ in CA (§5.2.2.1), which suggests that the left morpheme boundaries in (inflected) imperfect verbs are obliterated in BA, leading to monophthongization.<sup>15</sup> Similar examples of a reflex /ee/ are fewer than those cited for /oo/ (Erwin 1963:110).

## (57) Diphthongs across morpheme boundary in imperfect verbs

<i>ʔo-osʔif</i>	‘I describe’	<i>no-ogaḥ</i>	‘we fall’
<i>to-ogaḥ</i>	‘you MS stop’	<i>to-ozni:n</i>	‘you FS weigh’
<i>jo-oḏʔaḥ</i>	‘he/it hurts’	<i>to-osʔal</i>	‘she arrives’
<i>to-oḥdu:n</i>	‘you PL promise’	<i>jo-ormu:n</i>	‘they swell up’
<i>te-ebas</i>	‘she dries’	<i>ne-eʔas</i>	‘we despair’

<sup>15</sup> The diphthong /aj/ occurs in some compound forms composed of the negative particle *ma-* followed by an imperfect verb with a long initial vowel, as in *ma-jsʔi:r* ‘definitely not’, *ma-jxa:lif* ‘never mind’ (Abu-Haidar 2006:224). These compounds create a different kind of morpheme boundary, especially that the negative particle may occur independently with a long vowel as in *ma-*.

## 5.3.2.2 Medial-Weak Roots CGC/CGCC

The vast majority of generic and common nouns from medial-weak roots surface with the long mid vowels /ee/ and /oo/ (Blanc 1964:50). Morphological alternations often include a target form with a long mid vowel and one or more lexical items where the radical glide /j/ or /w/ appears, as exemplified in (58a–b).

## (58) Long mid vowels in nouns

	<i>target</i>		<i>alternation</i>		√
a.	<i>beeʃ</i>	‘selling’	<i>bajja:ʃ</i>	‘salesman’	bjʃ
	<i>deen</i>	‘debt’	<i>dajjan</i>	‘he lent’	djn
	<i>xeer</i>	‘good N’	<i>xajjar</i>	‘he let choose’	xjr
	<i>sʕeɛd</i>	‘hunting’	<i>tsʕajjad</i>	‘he went hunting’	sʕjd
	<i>tʕeɛf</i>	‘vision’	<i>?atʕja:f</i>	‘visions’	tʕf
	<i>feela</i>	‘headscarf’	<i>ʃijal</i>	‘headscarves’	ʃjl
	<i>yeer</i>	‘other’	<i>tayji:r</i>	‘changing’	ɣjr
	<i>meetam</i>	‘orphanage’	<i>maja:tim</i>	‘orphanages’	jtm
b.	<i>xoof</i>	‘fear’	<i>xawwa:f</i>	‘timid’	xwf
	<i>zooɕ</i>	‘husband’	<i>za:wadɕ</i>	‘he mated’	zwɕ
	<i>dooxa</i>	‘dizziness’	<i>dawwax</i>	‘he made dizzy’	dwx
	<i>tʕoɔr</i>	‘period of time’	<i>tʕʕawwʔar</i>	‘he evolved’	tʕwr
	<i>sʕoɔtʕ</i>	‘voice’	<i>?asʕwʔ:tʕ</i>	‘voices’	sʕwtʕ
	<i>kooma</i>	‘pile’	<i>kuwam</i>	‘piles’	kwm
	<i>loon</i>	‘color’	<i>talwi:n</i>	‘coloring’	lwn

Most, but not all, adjectival forms of this pattern are feminine adjectives denoting color and physical characteristics (Erwin 1963:254). As shown in (59), some of their morphological alternations—e.g., the masculine form or measure II and IX verbs—surface with a glide.

## (59) Long mid vowels in adjectives

	<i>target</i>		<i>alternation</i>		√
	<i>sooda</i>	‘black FS’	<i>swadd</i>	‘it turned black’	swd
	<i>bɛɛðʕa</i>	‘white FS’	<i>baʕa:ðʕ</i>	‘whiteness’	bjðʕ
	<i>ʃooora</i>	‘one-eyed FS’	<i>?aʃwar</i>	‘one-eyed MS’	ʃwr
	<i>ħoola</i>	‘squint-eyed FS’	<i>?aħwal</i>	‘squint-eyed MS’	ħwl
	<i>zeen</i>	‘nice’	<i>zajjan</i>	‘he shaved’	zjn

If the medial-weak roots are replaced by sound roots, all target forms in (58) and (59) will have the shape CaCC instead of CeeC/CooC, and otherwise identical templatic patterns as shown in (60a–b). The only exception is underlyingly monosyllabic CaCC from sound roots, which will break up the final cluster by epenthesis unless followed by a vowel-initial morpheme (§4.3.1). As argued earlier, this may provide evidence



for native speakers that the monophthongizing forms (from medial-weak roots) are underlyingly //CaGC// (where G stands for glide). The underlying diphthong //aG// undergoes assimilation whereby it surfaces as a long mid vowel /ee/ or /oo/. This synchronic evidence is confirmed by the fact that none of the morphological alternations that surface with a glide has a mid vowel as well. Furthermore, it is consistent with diachronic evidence from Old Arabic.

## (60) Sound roots

	<i>target</i>		<i>alternation</i>		√
a.	<i>tʕāhin</i>	‘grinding’	<i>tʕāḥḥa:n</i>	‘miller’	tʕhn
	<i>xalif</i>	‘contradicting’	<i>xa:laf</i>	‘he contradicted’	xlf
	<i>ʃamis</i>	‘sun’	<i>ʃammas</i>	‘he sunned’	ʃms
	<i>raǧuṣʕ</i>	‘dancing’	<i>traǧǧaṣʕ</i>	‘he pranced’	rgṣʕ
	<i>wazin</i>	‘weight’	<i>?awza:n</i>	‘weights’	wzn
	<i>ǧantʕa</i>	‘bag’	<i>ǧinaṭʕ</i>	‘bags’	ǧntʕ
	<i>fariʕ</i>	‘twig’	<i>tafri:ʕ</i>	‘branching’	frʕ
	<i>mablay</i>	‘amount’	<i>maba:liy</i>	‘amounts’	bly
b.	<i>sʕafra</i>	‘yellow FS’	<i>sʕarʕ</i>	‘it turned yellow’	sʕfr
	<i>ḥamra</i>	‘red FS’	<i>ḥamar</i>	‘redness’	ḥmr
	<i>tʕarʕa</i>	‘mute FS’	<i>?atʕarʕ</i>	‘deaf MS’	tʕrʕ

Baghdadi also has a large group of new and borrowed words with long /ee/ and /oo/, which have no correspondents in OA. (61a) exemplifies some foreign nouns with long mid vowels in their first syllable, whereas (61b) shows words with long mid vowels in their final or only syllable. And although very few morphological alternations in this class include a glide /j/ or /w/, it is unnecessary to assume underlying mid vowels. By taking McCarthy’s (2005b) free ride on morpho-phonemic learning, the non-alternating form can be derived from an independently motivated diphthongal source.

## (61) Long mid vowels in words of non-OA origin

a.	<i>doofag</i>	‘mattress’	<i>koosaǧ</i>	‘shark’
	<i>gootra</i>	‘undifferentiated’	<i>ḥoṭṭra</i>	‘powder’
	<i>boojinba:y</i>	‘necktie’	<i>boora:ni</i>	‘eggplant dish’
	<i>puteeta</i>	‘potatoes’	<i>beeǧa:ma</i>	‘pajamas’
	<i>kleetʕa</i>	‘a kind of cookie’	<i>ʕeeraz</i>	‘sesame oil’
b.	<i>heel</i>	‘cardamom’	<i>peek</i>	‘shot of liquor’
	<i>weer</i>	‘payment’	<i>meez</i>	‘table’
	<i>jood</i>	‘iodine’	<i>xoof</i>	‘good’
	<i>ba:lʕoṭ</i>	‘balloon’	<i>ma:lʕoṭ</i>	‘yacht’
	<i>pa:nsjoon</i>	‘apartment house’	<i>doondirma</i>	‘ice cream’
	<i>sikirteer</i>	‘secretary’	<i>su:peer</i>	‘trench’

Words with geminate glides do not undergo monophthongization in BA (Blanc 1964: 50). (62a) exemplifies monosyllabic words, while (62b–c) exemplify causative and reflexive measure III and V verbs and derivatives thereof (including nouns of instrument and profession). Many forms of the latter type have morphological alternations that include a mid vowel (see also (58)), providing partial evidence for the learner that long mid vowels are derived from underlying diphthongs.

## (62) Geminate glides as blockers to monophthongization

a.	<i>rajj</i>	‘irrigation’	<i>majj</i>	‘water’
	<i>zajj</i>	‘costume’	<i>fajj</i>	‘shade/shadow’
	<i>taww</i>	‘just now’	<i>ɕaww</i>	‘atmosphere’
b.	<i>bajjan</i>	‘he appeared’	<i>tkajjaf</i>	‘he adapted himself’
	<i>sajjaɕ</i>	‘he fenced in’	<i>msajjaɕ</i>	‘fenced’
	<i>bawwam</i>	‘he cried’	<i>thawwal</i>	‘he was transferred’
	<i>dawwar</i>	‘he showed around’	<i>mdawwar</i>	‘round’
c.	<i>xajja:t<sup>f</sup></i>	‘tailor’	<i>sajja:d</i>	‘fisherman’
	<i>dajja:n</i>	‘creditor’	<i>sajja:ra</i>	‘car’
	<i>bawwa:b</i>	‘doorkeeper’	<i>bawwa:ba</i>	‘gate’
	<i>bawwa:g</i>	‘thief’	<i>gawwa:d</i>	‘pimp’
	<i>ɕawwa:l</i>	‘cell phone’	<i>?awwal</i>	‘first’

Recall from §2.3.3 that a geminate is de-geminated when it comes in direct contact with a following consonant. As regards sequences of low vowels followed by geminate glides (such as those above), they will be reduced to simple diphthongs /aj/ or /aw/ that do not undergo monophthongization, as shown in (63).

## (63) De-gemination resulting in diphthongs

<i>fajj</i>	‘shade/shadow’	<i>faj-ha</i>	‘her shadow’
<i>ɕaww</i>	‘atmosphere’	<i>ɕaw-na</i>	‘our atmosphere’
<i>majjit</i>	‘dead MS’	<i>maj-ta</i>	‘dead FS’
<i>zajjaf</i>	‘he counterfeited’	<i>zajf-aw</i>	‘they counterfeited’
<i>xajjar</i>	‘he let choose’	<i>xajr-oohum</i>	‘they let them choose’
<i>hawwal</i>	‘he transferred’	<i>hawl-at</i>	‘she transferred’
<i>mawwat</i>	‘he killed’	<i>maw-ta</i>	‘he killed him’

In BA, there are also some derivationally unproductive or semi-productive classes that retain the diphthongs /aj/ and /aw/ stem-medially. The first class comprises nouns derived from quadriliteral consonantal roots (64a), some of which have variants that undergo monophthongization. For example, *ɕawhar* ‘core’ has a distinct meaning to *ɕoohar* ‘tint’. Also, *hajwa:n* ‘animal’ has the alternants *heewa:n* and *hi:wa:n* used by

older speakers.<sup>16</sup> On the other hand, most quadrilateral verbs with a C<sub>2</sub> glide radical exhibit /e/ and /oo/ in their initial syllable (Blanc 1964:110). All the verbs in (64b) convey a notion of “drawn-out episodes of action”, sometimes with pejorative connotations (Holes 1995:107). This parallels the exceptional behavior of imperfect verbs in (57) above.

(64) Surface diphthongs and monophthongs in nouns and verbs of quadrilateral origin

a.	<i>sawsan</i>	‘lily’	<i>mawsim</i>	‘season’
	<i>ḡawhar</i>	‘core’	<i>rawnaq</i>	‘glamour’
	<i>hajkal</i>	‘internal structure’	<i>bajdaq</i>	‘pawn (chess)’
	<i>fajru:z</i>	‘turquoise’	<i>bajrut</i>	‘Beirut’
	<i>ḥajwan</i>	‘animal’	<i>hajwana</i>	‘senselessness’
	<i>sʕajḍali</i>	‘pharmacist’	<i>sʕajḍala</i>	‘pharmacology’
b.	<i>soolaf</i>	‘he reminisced’	<i>soodan</i>	‘he made crazy’
	<i>xoozaq</i>	‘he cheated’	<i>dooxan</i>	‘he felt dizzy’
	<i>sʕoofar</i>	‘he whistled’	<i>tʔoofarḥ</i>	‘he staggered’
	<i>deewar</i>	‘he turned’	<i>neefan</i>	‘he aimed’
	<i>sʕeetʔar</i>	‘he dominated’	<i>ʕeetʔan</i>	‘it mellowed’
	<i>seeraz</i>	‘he sewed a border’	<i>tʔeeqal</i>	‘he was self-important’

The application of monophthongization is blocked within several BA adjectives, especially those ending in the *nisba* suffix *-i*. This may lead to some interesting oppositions with nouns ending in the first person possessive suffix *-i*, as shown in (65). Although the pattern appears to be systematic, the adjectival forms with surface diphthongs are indeed lexicalized.

(65) Diphthong-mid vowel oppositions in adjectives and nouns

<i>bajti</i>	‘domestic’	<i>beeti</i>	‘my house’
<i>xajri</i>	‘charitable’	<i>xeeri</i>	‘my good’
<i>dawri</i>	‘rotating’	<i>doori</i>	‘my turn’
<i>jawmi</i>	‘daily’	<i>joomi</i>	‘my day’
<i>ḥawri</i>	‘revolutionary’	<i>ḥoori</i>	‘my bull’
<i>zawḡi</i>	‘matrimonial’	<i>zooḡi</i>	‘my husband’

The third set of examples comprises Standard Arabic borrowings from trilateral roots, which belong to a wide range of patterns. Established *classicisms* can be differentiated from native usage, particularly if they contrast with BA words (Altoma 1969: 24), as exemplified in (66b). Words in (66c) exhibit intra-speaker variation, while

<sup>16</sup> Several other Old Arabic words with the pattern CaGCa:n correspond to BA /i:/ and /u:/ when G is /j/ or /w/, respectively (Malaika 1963:3, Altoma 1969:21)—e.g., *ʕi:ʔa:n* ‘Satan’, *ri:ḥa:n* ‘myrtle’, *mi:da:n* ‘square’, and *ḡu:ʕa:n* ‘hungry’. But very little synchronic evidence of an underlying diphthong can be found; hence the loss of /a/ from the OA diphthong in this pattern is best seen as a historical remnant.

those in (66d) comprise a class of proper names. We should note that borrowings from Standard Arabic are in continuous flow, and that some may be nativized faster than others. For the purposes of this study, however, all classicisms that retain the diphthongs will be regarded as lexical exceptions.<sup>17</sup>

## (66) Surface diphthongs in Standard Arabic borrowings

a.	<i>fawḏa</i>	‘chaos’	<i>dawla</i>	‘state’
	<i>rawḏa</i>	‘kindergarten’	<i>rawfa</i>	‘marvelousness’
	<i>tawja</i>	‘folder’	<i>zawraʔ</i>	‘an epithet for Baghdad’
b.	<i>fajn</i>	‘senator’	<i>ʔeen</i>	‘eye’
	<i>dawra</i>	‘session’	<i>doora</i>	‘turn’
	<i>fawra</i>	‘private parts’	<i>ʔoora</i>	‘one-eyed FS’
	<i>qawseen</i>	‘parentheses’	<i>qoos</i>	‘bow’
c.	<i>zawḏa</i>	~	<i>zooḏa</i>	‘wife’
	<i>ḏawqa</i>	~	<i>ḏooqa</i>	‘band’
	<i>ḏajf</i>	~	<i>ḏeeʔ</i>	‘army’
	<i>ḥajθ</i>	~	<i>ḥeeθ</i>	(a curse)
d.	<i>xawla</i>	(female name)	<i>majsu:n</i>	(female name)
	<i>lajla</i>	(female name)	<i>qajs</i>	(male name)

One last point here concerns the diphthongs /a:j/ and /a:w/, which mainly appear in BA where CA displays /aj/ and /aw/ after vowel shortening. This implies a difference between the two varieties with respect to syllabification mechanisms, as will be discussed in §5.3.3. The right-hand column in (67a) comprises feminine singular and masculine plural active participles, in which the second radical is always /j/ (Erwin 1963:222) due to the historical paradigm convergence described in §5.2.2.4. These can be compared to the corresponding (base) masculine singular forms to their left where the low vowel /a:/ and the glide element /j, w/ belong to different syllables. The same non-monophthongizing /a:j/ and /a:w/ sequences are created when vowel-initial pronominal suffixes are added to the base form of measure III verbs, as shown in (67b). Both patterns are explained through phonological derivations in §5.3.3.3.

## (67) Diphthongs /a:j/ and /a:w/ in BA active participles and conjugated verbs

a.	<i>ḏajig</i>	‘tasting MS’	<i>ḏajg-a</i>	‘tasting FS’
	<i>najim</i>	‘sleeping MS’	<i>najm-a</i>	‘sleeping FS’
	<i>gajim</i>	‘getting up MS’	<i>gajm-a</i>	‘getting up FS’
	<i>xajif</i>	‘afraid MS’	<i>xajf-i:n</i>	‘afraid MPL’
	<i>rajih</i>	‘going MS’	<i>rajh-i:n</i>	‘going MPL’

<sup>17</sup> Interestingly, new foreign loanwords in the language that contain /o/ or /e/ may appear with diphthongs instead, e.g., *talajfun* ‘telephone’, *lajzar* ‘laser’, and *pajdar* ‘pedal’ (Malaika 1963:3). This is likely a case of hypercorrection.

b. <i>zajjad</i>	‘he bid’	<i>zajd-at</i>	‘she bid’
<i>jitbajan</i>	‘he varies’	<i>jitbajn-u:n</i>	‘they vary’
<i>dar:wam</i>	‘he continued’	<i>dar:wm-at</i>	‘she continued’
<i>tʃa:wan</i>	‘he cooperated’	<i>tʃa:wn-aw</i>	‘they cooperated’
<i>jʃa:war</i>	‘he whispers to’	<i>tʃa:wr-i:n</i>	‘you FS whisper to’
<i>jsa:wam</i>	‘he bargains’	<i>tsa:wm-u:n</i>	‘you MPL bargain’

## 5.3.2.3 Final-Weak Roots CCG

Baghdadi displays /ee/ (but never /oo/) in final-weak verbs of various measures before a consonant-initial suffix (Odden 1978:139), as exemplified in (68). The base pattern (third person masculine singular) for all these verbs ends in /a/, which merges with the root-final radical /j/ to form a long mid vowel (Blanc 1964:102). Thus based on evidence from sound roots (e.g., *yanneeti* ‘you FS sang’ versus *baddalti* ‘you FS changed’), we may posit an underlying //ai// that undergoes monophthongization (cf. Broselow 2008:142–5 who denies a synchronic analysis of /ee/ in this class).

## (68) Long mid vowels in verbs of final-weak roots

<i>target</i>		<i>alternation</i>		√
<i>gaddeet</i>	‘I begged’	<i>gda:ja</i>	‘begging’	gdj
<i>ʃtikeena</i>	‘we complained’	<i>ʃakwa</i>	‘complaint’	ʃkw
<i>ɕ(i)reet</i>	‘you MS ran’	<i>ɕaraja:n</i>	‘flow’	ɕrj
<i>yanneeti</i>	‘you FS sang’	<i>ʔuynija</i>	‘song’	ʔnj
<i>ǰ(i)ðeʔtu</i>	‘you PL finished’	<i>ǰiðʔja:n</i>	‘finishing’	ǰðʔj
<i>n(i)feet</i>	‘I banished’	<i>nifa:ja</i>	‘castoff’	nfj

Parallel to (67) above, BA nouns ending in the templatic pattern -Ca:Ga (derived from final-weak roots) surface with the diphthongs /a:j/ and /a:w/ after suffixation of vowel-initial possessive pronouns (where CA has /aj/ and /aw/). As shown in (69a), these feminine nouns will appear in their construct state (with a final /t/) before pronominal endings. The diphthongs /a:j/ and /a:w/ also appear in word-final position in a number of other words (listed in (69b) from Shamdin Agha 1969:74). Only two words, both loans, have word-medial /a:w/: *ka:wli* ‘gypsy’ and *xa:wli* ‘towel’.

## (69) Diphthongs /a:j/ and /a:w/ in BA nouns of final-weak roots

a. <i>ya:ja</i>	‘purpose’	<i>ya:jti</i>	‘my purpose’
<i>riʃa:ja</i>	‘care’	<i>riʃa:jtak</i>	‘your MS care’
<i>bina:ja</i>	‘building’	<i>bina:jtitf</i>	‘your FS building’
<i>ʃada:wa</i>	‘enmity’	<i>ʃada:wti</i>	‘my enmity’
<i>bada:wa</i>	‘bedouinism’	<i>bada:wtitf</i>	‘your FS bedouinism’
<i>ħafa:wa</i>	‘friendly reception’	<i>ħafa:wta</i>	‘his friendly reception’
b. <i>tʃa:j</i>	‘tea’	<i>na:j</i>	‘flute’
<i>ja:j</i>	‘spring’	<i>ha:j</i>	‘this FS’

<i>ǧa:j</i>	‘coming MS’	<i>sara:j</i>	‘government offices’
<i>kla:w</i>	‘skull cap’	<i>sħa:w</i>	‘local wrestling’
<i>fa:w</i>	(Iraqi town)	<i>wa:w</i>	(Arabic letter)

## 5.3.2.4 Prepositions and Clitics

The preposition *ʕala* ‘on’ behaves similar to the verbs derived from final-weak roots (Blanc 1964:122). The final /a/ vowel is replaced by /ee/ before an object pronoun suffix, as in (70a). A glide /j/ appears as part of a diphthong in the geminated form *ʕalajja* ‘on me’, providing ground for the assumption that surface /ee/ is derived from underlying //ai// by monophthongization. On the other hand, long mid vowels appear in the dual marker *-een* (70b), which does surface with diphthongs /aw/ and /aj/ in certain other varieties of Arabic, and we may reasonably posit an underlying //ai//.

## (70) Long mid vowels in non-verbal derivations

a.	<i>ʕalajja</i>	‘on me’	<i>ʕaleena</i>	‘on us’
	<i>ʕalee</i>	‘on him’	<i>ʕaleeha</i>	‘on her’
	<i>ʕaleek</i>	‘on you MS’	<i>ʕaleetf</i>	‘on you FS’
	<i>ʕaleekum</i>	‘on you PL’	<i>ʕaleehum</i>	‘on them’
b.	<i>bint-een</i>	‘two girls’	<i>gabr-een</i>	‘two graves’
	<i>ǧibal-een</i>	‘two mountains’	<i>qalam-een</i>	‘two pencils’
	<i>goofar-een</i>	‘two baskets’	<i>maktu:b-een</i>	‘two letters’

Finally, the third person plural subject suffix surfaces as a diphthong *-aw*. This can be interpreted as a ban against mid vowels in word-final open syllables. Interestingly, the suffix becomes /oo/ when object suffixes are added (Blanc 1964:62), i.e., when it is no longer word-final, as shown in (71). A seeming exception to this generalization is the post-vocalic *null* third person masculine singular object pronoun where /oo/ appears word finally, as in *tħilb-oo* ‘they asked for him’ (compare with *ʕalee* ‘on him’ in (70)). But, as argued in CA, the lack of contrast between a final long vowel and a final long vowel plus /h/ supports the otherwise diachronic assumption that this suffix is underlyingly //h// that has disappeared on the surface. The only true exception to this generalization is the conjunction *loo* ‘or’.

## (71) Alternations involving diphthongs vs. mid vowels of 3PL suffix

<i>ǧa:baw</i>	‘they brought’	<i>ǧa:boo-ni</i>	‘they brought me’
<i>diraw</i>	‘they knew’	<i>diroo-na</i>	‘they knew us’
<i>tħbaw</i>	‘they got tired’	<i>tħboo-k</i>	‘they tired you MS’
<i>ħabbaw</i>	‘they liked’	<i>ħabboo-tf</i>	‘they liked you FS’
<i>xa:braw</i>	‘they phoned’	<i>xa:broo-kum</i>	‘they phoned you PL’
<i>tħilbaw</i>	‘they requested’	<i>tħilboo-</i>	‘they asked for him’
<i>sawwaw</i>	‘they made’	<i>sawwoo-ha</i>	‘they made her’
<i>fa:faw</i>	‘they saw’	<i>fa:foo-hum</i>	‘they saw them’

### 5.3.2.5 Interim Generalizations

The previous discussion provided evidence that surface /ee/ and /oo/ are derived from underlying //ai// and //au// in BA. Monophthongization applies within various types of morphemes including verbs, nouns, adjectives, and clitics (both stressed and unstressed). I have shown that instances of surface diphthongs can be classified in some well-defined environments: (i) when the diphthong is derived across two adjacent morphemes (56a–e); (ii) when the diphthong is phonologically derived from a non-diphthongal base form (67, 69); (iii) when the low vowel of the diphthong is followed by a geminate glide (62) or after de-gemination (63); (iv) in word-final position (71); (v) in nouns derived from quadriliteral roots (64a); and (vi) in some lexical exceptions including loanwords, which preserve the diphthong morpheme-internally (65–66). This suggests that monophthongization applies in a systematic way, refuting claims that the process is synchronically inactive and that the language has underlyingly long mid vowels.

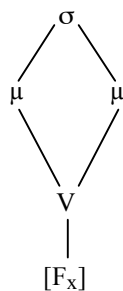
### 5.3.3 Features and Representations in BA Monophthongization

The present section begins with a brief discussion of the featural and moraic representations of BA long mid vowels and diphthongs. Then it thoroughly examines various phonological processes that interact with monophthongization in BA.

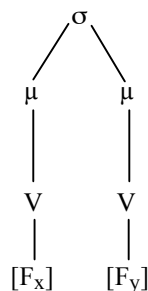
#### 5.3.3.1 Moraic Representations

Moraic representations of Baghdadi long mid vowels and diphthongs are identical to those of Cairene. The diagrams in (72) are only a reminder of how various contents of the nucleus are structured in moraic theory, and the reader is referred back to §5.2.3.1 for a complete discussion of other logical representational possibilities.

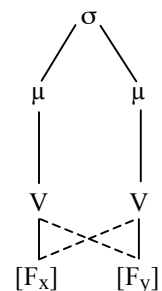
(72) a. True Long Vowel



b. Diphthong



c. False Long Vowel



The representation in (72a) shows that a true long vowel has a single root node and one set of features, and that it must be underlyingly bimoraic. Diphthongs (72b) are analyzed as sequences of non-identical vowels that do not share any features. They surface with two moras associated with two root nodes that have different features. Finally, long mid vowels are structurally represented in (72c) as a sequence of two different vowels (a diphthong) sharing two sets of features by assimilation. Analyzing /ee/ and /oo/ in this way resolves the mystery of the absent short mid vowels in BA.

As underlying diphthongs that become false long vowels, they are never underlyingly bimoraic (like true long vowels) and need not have a mono-moraic cognate on the surface.

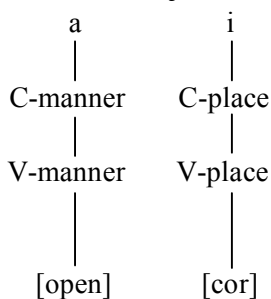
### 5.3.3.2 Autosegmental Representations

The relevant segments for monophthongization are the vowels /a/, /i/, and /u/. In the previous chapter(s), I provided evidence that /a/ is specified for V-manner[open] and /i/ for V-place[cor]. I have also argued that underlying //u// is composed of a single V-place[lab], and that surface /u/ acquires an additional V-place[dor]. Recall that only syllabic position differentiates between high vowels and glides in most Arabic dialects (Rahim 1980:212, Holes 1995:47). Hence /j/ and /w/ have the same feature composition as /i/ and /u/, respectively.

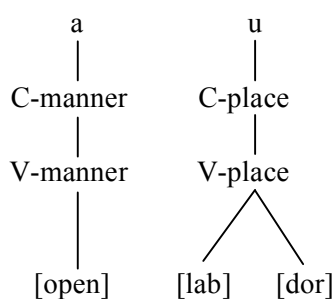
We have seen earlier that long mid vowels in Baghdadi result from full feature assimilation of certain underlying vowel sequences (a low and a high vowel). These sequences surface faithfully, viz., as diphthongs in particular morpho-phonological contexts, and otherwise they surface as long mid vowels. The diagrams in (73) show that long mid vowels and diphthongs are formed from the same underlying sequences (see Bellem 2007:25–6 for similar insights within Element Theory). But whereas /aj/ and /ee/ are featurally identical (73a and 73c), /aw/ receives a redundant V-place[dor] feature on the surface that /oo/ does not have (73b and 73d).

#### (73) BA diphthongs and long mid vowels

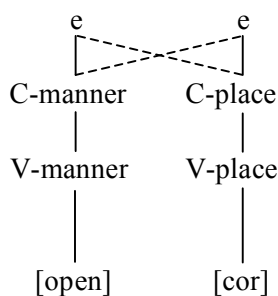
a. //ai// → /aj/



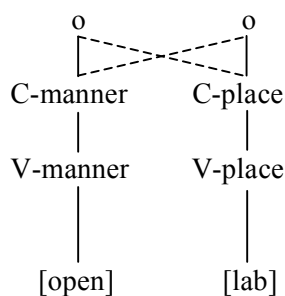
b. //au// → /aw/



c. //ai// → /ee/



d. //au// → /oo/





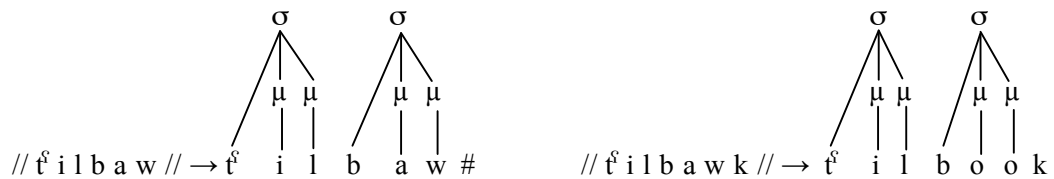
## 5.3.3.3 Phonological Strategies

The assimilation of an underlying sequence of a low and a high vowel is illustrated in (74). When the underlying diphthong in //baiʔ// undergoes monophthongization, the two root nodes of the nucleus are preserved and a false long mid vowel appears on the surface, ergo *beef*.

## (74) BA Monophthongization



The environments where diphthong assimilation does not apply fall under specific categories. With the exception of prefixed imperfect verbs, any diphthong spanning two morphemes fails to surface as a long mid vowel. This can be interpreted as a requirement to preserve the identity of each morpheme (see §5.3.4). The diphthongal suffix *-aw* ‘they’ is also preserved by virtue of its word-final position. But once an additional suffix is attached, the former is no longer final and must undergo monophthongization. This is demonstrated in (75) with the object suffix *-k* ‘your’.

(75) The suffix *-aw* in word-final and non-final position

Diphthongs that have an initial long vowel preceding the semivowel do not undergo monophthongization.<sup>18</sup> Unlike CA, closed syllable shortening never takes place in Baghdadi. The result is that diphthongs /a:j/ and /a:w/ occur in both word-medial and final positions. The restriction against monophthongization in final position (75) is sufficient to account for the latter. Instances of word-medial /a:j/ and /a:w/ in (67a–b) and (69a) reflect some level of faithfulness to a base form (e.g., stem noun, masculine singular participle, third person masculine singular verb) that syllabifies /a:/ and the glide in different syllables. In the inflected form, the addition of a vowel-initial suffix results in the deletion of the nucleus in the second (now open) syllable, and the onset glide is re-syllabified in the coda of the preceding syllable. This rule of syncope, formulated in (76), enforces deletion of any vowel in two-sided open syllables (Odden 1978:143). Note that while only high vowels are deleted in most Arabic dialects, BA deletes vowels of any height in medial open syllables (Farwaneh 1995:102). These

<sup>18</sup> Within the historical framework, the contraction of the sequences /a:j/ and /a:w/ to /ee/ and /oo/ is not attested in any of the Semitic languages and cannot be assumed (Bravmann 1977:121–2).

so-called non-differential dialects (including Syrian) extend the target of syncope to low vowels, but as the markedness hierarchy predicts, they must also syncope high vowels (Gouskova 2003).

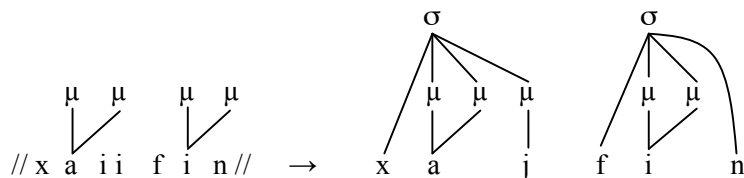
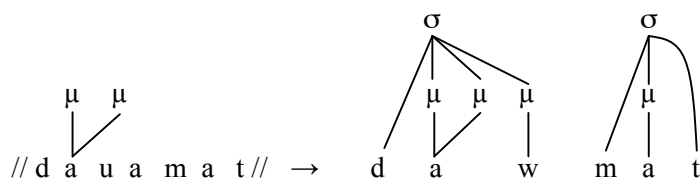
## (76) BA Syncope

// i, u, a // → ∅ / CV.C— .CV(C)

Now let us examine real instances of word-medial /a:j/ and /a:w/ where the diphthong escapes assimilation into a mid vowel. The inflected forms *xa:jf-i:n* ‘afraid PL’ and *da:w-m-at* ‘she continued’ can be derived directly from the relevant base forms, as in (77a). These are straightforward derivations where only syncope and resyllabification take place, so it is unnecessary to draw an analogy based on sound roots. Note that the syncope vowel is /i/ and /a/ in the active participle and perfect verb, respectively. These are illustrated representationally in (77b–c).

## (77) Deriving word-medial /a:j/ and /a:w/ diphthongs from hollow roots

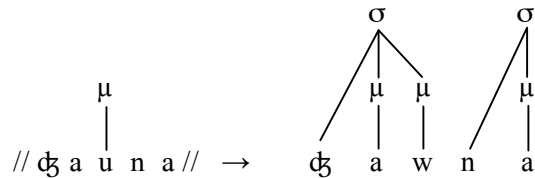
a.	//xa:iif-i:n //	Underlying Representation	//da:uam-at //
	<i>xa:ᵹjᵹfi:n</i> <sub>σ</sub>	Onset Formation	<i>da:ᵹwaᵹmat</i> <sub>σ</sub>
	<i>xa:ᵹjᵹfi:n</i> <sub>σ</sub>	Syncope	<i>da:wᵹmat</i> <sub>σ</sub>
	<i>xa:jᵹfi:n</i> <sub>σ</sub>	Coda Formation	<i>da:wᵹmat</i> <sub>σ</sub>
	<span style="border: 1px solid black; padding: 2px;"><i>xa:jfi:n</i></span>	Surface Representation	<span style="border: 1px solid black; padding: 2px;"><i>da:wmat</i></span>

b. //xa:iif-i:n // → *xa:j.fi:n* ‘afraid PL’c. //da:uam-at // → *da:w.mat* ‘she continued’

Finally, monophthongization is blocked when the low vowel of the diphthong is followed by a geminate glide and also after de-gemination. The syllabification of a geminate in two adjacent syllables simultaneously makes it invulnerable to most phonological processes, as a result of geminate inalterability. Geminate glides are degeminated when they come in direct contact with a following consonant, and the resulting diphthongs also resist monophthongization. Below, I examine the relevant aspects of glide degemination and how that relates to monophthongization in BA.

Phrase-final geminates serve as codas, but they are still distinguishable from a singleton coda consonant by virtue of being moraic, since they add weight to the syllable and attract stress (see Davis 2011 and references therein). Word-final codas, on the other hand, have been argued to be extrametrical in order to explain why CVC syllables fail to receive stress in this position. Recall that degemination takes place when the geminate glide comes in direct contact with a following consonant. For example, if we attach the possessive suffix *-na* to the geminate-final word *ǧaww* ‘atmosphere’, the moraic coda is no longer special or indicative of a geminate (since all coda consonants are moraic in non-final position). As illustrated in diagram (78), the following consonant will serve as the onset of the second syllable and, as a consequence, the original /w/ coda will lose its geminate property. That is to say, it will degeminate (see Curtis 2003:119).

(78) //ǧau<sup>u</sup>na// → ǧawna ‘our atmosphere’

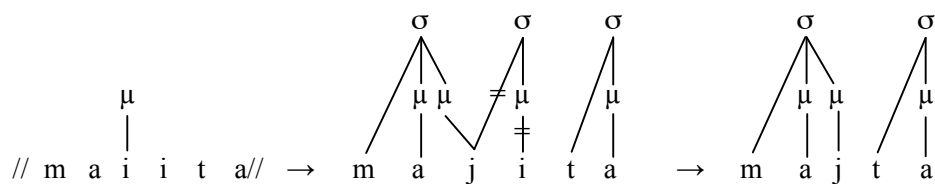


On the surface, word-medial geminate glides are doubly linked to the final mora of one syllable and the syllable node of the following syllable (Hayes 1989, McCarthy and Prince 1990). In other words, they are heterosyllabic in that they simultaneously serve as the coda of one syllable and the onset of another. The degemination of word-medial geminate glides is often derivationally preceded by syncope, as demonstrated in (79a). Consequently, the geminate will be linked to the coda of one syllable and the onset of another empty syllable. The latter attachment is lost to avoid a syllable with an empty nucleus (see also Farwaneh 2009:97). And this lost link to a second syllable results in degemination, as illustrated in (79b).

(79) Gemination and degemination

a.	//mai <sup>u</sup> it-a//	Underlying Representation	//ħau <sup>u</sup> al-at//
	maj <sub>σ</sub> ji <sub>σ</sub> ta <sub>σ</sub>	Onset Formation	ħaw <sub>σ</sub> wa <sub>σ</sub> lat <sub>σ</sub>
	maj <sub>σ</sub> j <sub>σ</sub> ta <sub>σ</sub>	Syncope	ħaw <sub>σ</sub> w <sub>σ</sub> lat <sub>σ</sub>
	maj <sub>σ</sub> ta <sub>σ</sub>	Degemination	ħaw <sub>σ</sub> lat <sub>σ</sub>
	<span style="border: 1px solid black; padding: 2px;">majta</span>	Surface Representation	<span style="border: 1px solid black; padding: 2px;">ħawlat</span>

b. //mai<sup>u</sup>it-a// → majta ‘dead FS’



To summarize, monophthongization fails to apply in some well-defined contexts. A long mid vowel target is illegal if the trigger diphthong is derived: (i) morphologically, where it spans a morpheme boundary, or (ii) phonologically, where it arises through other phonological rules (Hall 2006). Other systematic exceptions include geminates and word-final position—contexts that resist phonological processes across languages.

### 5.3.4 Constraints and Monophthongization in BA

Having characterized the behavior Baghdadhi monophthongization derivationally, this section attempts to analyze the process in classic Optimality Theory. To account for the assimilation, I propose constraints from the alignment family, which interact with general faithfulness constraints against feature insertion. DEB is justified through constraints that ensure faithfulness to a specific environment or to a base form in a morphological paradigm.

The appearance of false long vowels was explained as feature assimilation of particular underlying vowel sequences. The relevant constraints are those in (80a–c), which align the features V-manner[open], V-place[lab], and V-place[cor] to the right or left edges of the rime. These constraints interact with DEPLINK [F] (80d) against new associations of these three features in the output.

- (80) a. R-ALIGN V-[open]: Align a V-manner[open] feature to the right edge of the rime.  
 b. L-ALIGN V-[lab]: Align a V-place[lab] feature to the left edge of the rime.  
 c. L-ALIGN V-[cor]: Align a V-place[cor] feature to the left edge of the rime.  
 d. DEPLINK [F]: Do not associate any of the features V-manner[open] and V-place[lab/cor] to a segment that did not have it underlyingly.

Tableau (81) illustrates a typical instance of monophthongization in BA. By ranking the alignment constraints above DEPLINK [F], a potential candidate with a surface diphthong (81b) is eliminated in favor of one where the pertinent features are shared in the syllable rime (81a).

- (81) R-ALIGN V-[open], L-ALIGN V-[lab] >> DEPLINK [F]

	//xau <sup>u</sup> f//	R-ALIGN V-[open]	L-ALIGN V-[lab]	DEPLINK [F]
a.		*!	*!	
b.				**

To account for the lack of diphthong assimilation across a morpheme boundary, I will use  $\text{DEPLINK [F]/MORPH}^!$ , formulated in (36) above. This constraint penalizes potential outputs that associate certain features to a segment of another morpheme. As shown in Tableau (82), failure to comply with  $\text{DEPLINK [F]/MORPH}^!$  is fatal. Candidate (82a), which has a surface diphthong, is selected even though it violates  $\text{ALIGNMENT}$ .<sup>19</sup>

(82)  $\text{DEPLINK [F]/MORPH}^! \gg \text{R-ALIGN V-[open]}, \text{L-ALIGN V-[lab]} \gg \text{DEPLINK [F]}$

	//ma-ukib//	$\text{DEPLINK [F]/MORPH}^!$	$\text{R-ALIGN V-[open]}$	$\text{L-ALIGN V-[lab]}$	$\text{DEPLINK [F]}$
☞ a.	$\text{ma}^{\text{u}}\text{-w}^{\text{u}}\text{ki}^{\text{u}}\text{b}]_{\sigma}$		*	*	
b.	$\text{mo}^{\text{u}}\text{-o}^{\text{u}}\text{ki}^{\text{u}}\text{b}]_{\sigma}$	*!*			**

Another case of under-application is found in nouns derived from (the unproductive) quadrilateral roots. Exceptions of this type are frequently explained through morphologically relativized constraints. I propose the specific constraint  $\text{DEPLINK [F]/N}_{\text{QUADRI}}$  in (83a), and the more general  $\text{DEPLINK [F]}_{\text{QUADRI}}$  in (83b).

(83) a.  $\text{DEPLINK [F]/N}_{\text{QUADRI}}$ : Assign a violation mark to any instance of  $\text{DEPLINK [F]}$  that contains a phonological exponent of a noun derived from a quadrilateral root.

b.  $\text{DEPLINK [F]}_{\text{QUADRI}}$ : Assign a violation mark to any instance of  $\text{DEPLINK [F]}$  that contains a phonological exponent of a morpheme derived from a quadrilateral root.

Tableau (84) presents an instance of a quadrilateral noun, with the input //haikal//.  $\text{DEPLINK [F]/N}_{\text{QUADRI}}$  outranks  $\text{ALIGNMENT}$ , thus rejecting the unfaithful (assimilating) candidate (84b). However, as shown in Tableau (85), the top-ranked constraint is irrelevant for verbs. It follows that a verbal input like //saulaf// will surface optimally with a long mid vowel, given that  $\text{DEPLINK [F]}_{\text{QUADRI}}$  is ranked low in the hierarchy.

(84)  $\text{DEPLINK [F]/N}_{\text{QUADRI}} \gg \text{R-ALIGN V-[open]}, \text{L-ALIGN V-[cor]} \gg \text{DEPLINK [F]}_{\text{QUADRI}}, \text{DEPLINK [F]}$

	// haikal // <sub>noun</sub>	$\text{DEPLINK [F]/N}_{\text{QUADRI}}$	$\text{R-ALIGN V-[open]}$	$\text{L-ALIGN V-[cor]}$	$\text{DEPLINK [F]}_{\text{QUADRI}}$	$\text{DEPLINK [F]}$
☞ a.	$\text{ha}^{\text{u}}\text{-j}^{\text{u}}\text{ka}^{\text{u}}\text{l}]_{\sigma}$		*	*		
b.	$\text{he}^{\text{u}}\text{-e}^{\text{u}}\text{ka}^{\text{u}}\text{l}]_{\sigma}$	*!*			**	**

<sup>19</sup> Recall that long mid vowels surface across a morpheme boundary in the conjugated imperfect verbs of glide-initial roots (57). This hints at an additional post-lexical level at which monophthongization applies. In OT, this may be explained by means of a morphologically-indexed alignment constraint (in this specific context) that dominates  $\text{DEPLINK [F]/MORPH}$ . Having said that, I will not pursue a full analysis of this systematic exception here.

(85) DEPLINK [F]/N<sub>QUADRI</sub> >> R-ALIGN V-[open], L-ALIGN V-[lab] >> DEPLINK [F]<sub>QUADRI</sub>, DEPLINK [F]

	// saulaf // <sub>verb</sub>	DEPLINK [F]/N <sub>QUADRI</sub>	R-ALIGN V-[open]	L-ALIGN V-[lab]	DEPLINK [F] <sub>QUADRI</sub>	DEPLINK [F]
a.	sa <sup>u</sup> -w <sup>u</sup> ] <sub>σ</sub> la <sup>u</sup> f] <sub>σ</sub>		*!	*!		
b.	so <sup>u</sup> -o <sup>u</sup> ] <sub>σ</sub> la <sup>u</sup> f] <sub>σ</sub>				**	**

Another interesting instance of under-application is the suffix *-aw*, which does not undergo assimilation by virtue of its word-final position. I propose the undominated positional faithfulness constraint DEPLINK V-[open]# (see (40)), which penalizes spreading V-manner[open] (from //a//) to a word-final segment. The ranking in (86) selects an optimal output with no assimilation (86a). On the other hand, attaching an extra suffix will render *-aw* non-final (hence, /oo/ on the surface), and the constraint DEPLINK V-[open]# is vacuously satisfied.

(86) DEPLINK V-[open]# >> R-ALIGN V-[open], L-ALIGN V-[lab] >> DEPLINK [F]

	//kitb-au//	DEPLINK V-[open]#	R-ALIGN V-[open]	L-ALIGN V-[lab]	DEPLINK [F]
a.			*	*	
b.		*!			**

The above ranking is adequate to deal with occurrences of the diphthongs /aɨ/ and /aɨw/ in word-final position (69b). But word-medial /aɨ/ and /aɨw/ are not underlying. As discussed in §5.3.3.3 above, these are only derived through resyllabification and syncope. To account for BA syncope, we need several markedness constraints against monomoraic (short) vowels of any height. The two constraints formulated in (87a) and (87b) are sufficient for the present evaluation. One should stress that these are crucially dominated by the inviolable PHONOTACTICS constraints, hence no special reference to open syllables is necessary (Gouskova 2003:218). Note, however, that the constraint \* $\mu\mu\mu$  in (87c) is not highly ranked in BA where trimoraic syllables are allowed in word-medial and final position.

- (87) a. \*NUC/i: A monomoraic segment composed of just a V-place[cor] feature should not be in the nucleus.
- b. \*NUC/a: A monomoraic segment composed of just a V-manner[open] feature should not be in the nucleus.
- c. \* $\mu\mu\mu$ : no tri-moraic syllable is allowed.

The constraints in (87a–b) are in conflict with two corresponding faithfulness constraints (88a–b) that penalize /i/ and /a/ syncope, respectively. Closed syllable vowel shortening does not apply in BA, but I will include the constraint MAXLINK [ $\mu$ ] in (88c) for typological reasons.

- (88) a. MAX V-[cor]: Every V-place[cor] feature in the input has a correspondent V-place[cor] feature in the output.
- b. MAX V-[open]: Every V-manner[open] feature in the input has a correspondent V-manner[open] feature in the output.
- c. MAXLINK [ $\mu$ ]: If a segment has a mora in the input, it should also have a mora in the output.

The interaction of these constraints is illustrated in Tableau (89). MAXLINK [ $\mu$ ] is inviolable (PHONOTACTICS), and hence it must be ranked higher than \*NUC/a (and also \*NUC/i). It eliminates candidates (c) and (d), which shorten the underlying long vowel /a:/. In order for syncope to take place, \*NUC/V constraints must dominate the corresponding MAX [F]. This rules out (89b), which retains a short /a/ nucleus in an open syllable. Finally, \* $\mu\mu\mu$  is low-ranked since it is violated in the optimal output (89a).

- (89) MAXLINK [ $\mu$ ] >> \*NUC/i, \*NUC/a >> MAX V-[open], MAX V-[cor], \* $\mu\mu\mu$

	// da <sup>uu</sup> uam-at //	MAXLINK [ $\mu$ ]	*NUC/i	*NUC/a	MAX V-[open]	MAX V-[cor]	* $\mu\mu\mu$
a.	da <sup>uu</sup> w <sup>u</sup> ] <sub>σ</sub> ma <sup>u</sup> t] <sub>σ</sub>				*		*
b.	da <sup>uu</sup> ] <sub>σ</sub> wa <sup>u</sup> ] <sub>σ</sub> ma <sup>u</sup> t] <sub>σ</sub>			*!			
c.	da <sup>u</sup> ] <sub>σ</sub> wa <sup>u</sup> ] <sub>σ</sub> ma <sup>u</sup> t] <sub>σ</sub>	*!		*!			
d.	da <sup>u</sup> w <sup>u</sup> ] <sub>σ</sub> ma <sup>u</sup> t] <sub>σ</sub>	*!			*		

MAX [F] constraints must dominate ALIGNMENT so that monophthongization—where it applies—is preferred to vowel deletion (90a). In fact, ALIGNMENT violations are problematic for the non-monophthongizing /a:j/ and /a:w/ sequences above, simply because they prefer an output with long mid vowels. But if /a:j/ and /a:w/ are faithful to corresponding sequences in a base form (via paradigm uniformity), their behavior is justified. As shown in §5.3.3.3, all relevant base forms do not exhibit the context for monophthongization since they have /a:/ and the glide in different syllables. On that account, I propose the OP constraint in (90b) that prevents DEPLINK [F] to apply in other members of the paradigm.

- (90) a. MAX V-[open], MAX V-[cor] >> R-ALIGN V-[open], L-ALIGN V-[lab], L-ALIGN V-[cor] >> DEPLINK [F]  
 b. OP-DEPLINK [F]: Assign a violation mark to any instance of DEPLINK [F] in a morpheme whose output base form satisfies DEPLINK [F].

Tableau (91) incorporates OP-DEPLINK [F] into the constraint hierarchy. Once it outranks ALIGNMENT, the correct output paradigm (a) is selected. Note that \* $\mu\mu\mu$  must also be outranked by OP-DEPLINK [F].

- (91) OP-DEPLINK [F] >> \* $\mu\mu\mu$ , R-ALIGN V-[open], L-ALIGN V-[lab] >> DEPLINK [F]

	// da <sup>uu</sup> uam, da <sup>uu</sup> uam-at //	OP- DEPLINK [F]	* $\mu\mu\mu$	R-ALIGN V-[open]	L-ALIGN V-[lab]	DEPLINK [F]
☞ a.	< da <sup>uu</sup> ] <sub>σ</sub> wa <sup>u</sup> m] <sub>σ</sub> , da <sup>uu</sup> w <sup>u</sup> ] <sub>σ</sub> ma <sup>u</sup> t] <sub>σ</sub> >		*	*	*	
b.	< da <sup>uu</sup> ] <sub>σ</sub> wa <sup>u</sup> m] <sub>σ</sub> , do <sup>u</sup> o <sup>u</sup> ] <sub>σ</sub> ma <sup>u</sup> t] <sub>σ</sub> >	*!				**

The last category of blocked monophthongization involves geminate glides or after degemination. Geminate inalterability can be explained in OT by way of an undominated positional faithfulness constraint, DEPLINK V-[open]/ONSET (see (42)), that militates against spreading a V-manner[open] feature to a syllable onset (it does not matter that geminates are also in coda position). The ranking in Tableau (92) ensures that an input //ai<sup>u</sup>// does not surface as a long mid vowel (candidate (b)). Note that word-final geminate glides are not attached to a following onset, but the undominated DEPLINK V-[open]# will prevent assimilation.

- (92) DEPLINK V-[open]/ONSET >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	//bai <sup>u</sup> an//	DEPLINK V-[open]/ONSET	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
☞ a.			*	*	
b.		*!			**

Once word-medial geminate glides are degeminated (before a consonant), the onset attachment is no longer satisfied, but the resulting diphthong still resists assimilation. One way to resolve this is to utilize the same OP constraint in (90b). The base form in the input to Tableau (93) contains a surface diphthongal sequence. OP-DEPLINK [F] limits alternations among other surface allomorphs, and it will consequently impede



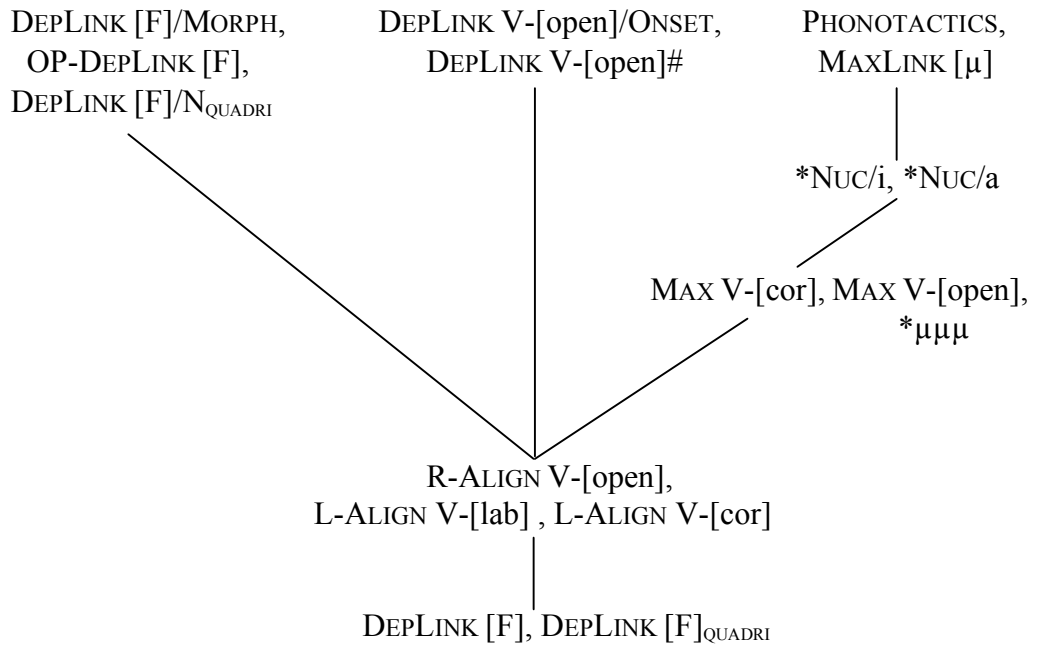
assimilation in (93d). An output that resists syncope in the feminine (93a) is ruled out via multiple \*NUC/i violations. Finally, an output that resists degemination (93b) is ruled out by way of PHONOTACTICS. Notice that only ALIGNMENT is crucially ranked with respect to OP-DEPLINK [F].

(93) OP-DEPLINK [F] >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F] AND PHONOTACTICS >> \*NUC/i >> MAX V-[cor] >> R-ALIGN V-[open], L-ALIGN V-[cor] >> DEPLINK [F]

	//mai <sup>u</sup> it, mai <sup>u</sup> it-a//	OP- DEPLINK [F]	PHONOTACTICS	*NUC/i	MAX V-[cor]	R-ALIGN V-[open]	L-ALIGN V-[cor]	DEPLINK [F]
a.	< ma <sup>u</sup> j <sup>u</sup> ] <sub>a</sub> ji <sup>u</sup> t] <sub>σ</sub> , ma <sup>u</sup> j <sup>u</sup> ] <sub>a</sub> i <sup>u</sup> ] <sub>σ</sub> ta <sup>u</sup> ] <sub>σ</sub> >			**!		**	**	
b.	< ma <sup>u</sup> j <sup>u</sup> ] <sub>a</sub> ji <sup>u</sup> t] <sub>σ</sub> , ma <sup>u</sup> j <sup>u</sup> ] <sub>a</sub> i <sup>u</sup> ] <sub>σ</sub> ta <sup>u</sup> ] <sub>σ</sub> >		*!	*	*	**	**	
⚡ c.	< ma <sup>u</sup> j <sup>u</sup> ] <sub>a</sub> ji <sup>u</sup> t] <sub>σ</sub> , ma <sup>u</sup> j <sup>u</sup> ] <sub>σ</sub> ta <sup>u</sup> ] <sub>σ</sub> >			*	*	**	**	
d.	< ma <sup>u</sup> j <sup>u</sup> ] <sub>a</sub> ji <sup>u</sup> t] <sub>σ</sub> , me <sup>u</sup> e <sup>u</sup> ] <sub>σ</sub> ta <sup>u</sup> ] <sub>σ</sub> >	*!		*	*	**		**

The full ranking for BA monophthongization is summarized in diagram (94).

(94) Constraint rankings for BA monophthongization



## 5.4 Conclusion

In this chapter, I investigated the full complexity of the phonological and morphological behavior of mid vowels and diphthongs in Cairene and Baghdadi Arabic. I also discussed several empirical and theoretical difficulties for the widely assumed synchronic-contrast position. First, a systematic look at the alternations of diphthongs and mid vowels reveals that they are in complementary distribution in both CA and BA. This leads to the conclusion that mid vowels are derived from underlying diphthongs in the synchronic grammar. In fact, I have shown that underlying diphthongs assimilate into false long mid vowels in most contexts, with systematic exceptions in well-defined environments (slightly different in the two dialects). Such environments, of a phonological or morphological nature, are known to be the locus of “exceptional” behavior across languages, and their resistance to monophthongization is, therefore, quite natural. Furthermore, I have argued that in some cases learners must generalize from alternating to non-alternating /ee/ and /oo/.

The major theoretical difficulty with the synchronic-contrast approach to CA and BA mid vowels is that it provides no synchronic account for the absence of short mid vowels. This conspicuous absence cannot be explained within standard theories of prosodic structure using a framework like Optimality Theory. And researchers denying a synchronic monophthongization account are left to explain the lack of short mid vowels—together with the systematic alternations—via stipulations. However, the account provided here makes a natural connection between historical, theoretical, and synchronic considerations to provide a unified analysis.

I have argued that the appearance of long mid vowels in CA and BA is the result of total assimilation of two adjacent vocalic root nodes. However, deriving all surface forms, whether long mid vowels or diphthongs, from diphthongal underlying representations posits a challenge to a computational theory with no intermediate levels of derivation such as OT. Positional faithfulness and OP constraints provided the tools to account for the “exceptions” to monophthongization in Cairene and Baghdadi.

# CHAPTER 6

## Palatalization

### 6.1 Background

The term “palatalization” encompasses a range of different but related phenomena, some are synchronic, phonetic or phonological, and others diachronic. Palatalization processes are commonly local, and are triggered primarily by front vocoids (vowels and glides) followed at a considerable distance by mid front vowels (Kochetov 2011). As a rule, the output consonants have some palatal articulation, and the nature of that articulation is the source of a principal division (see Lahiri and Evers 1991:80–1).

One type of palatalization involves the addition of secondary, i.e., vocalic, palatal articulation to the target consonant, while keeping its primary articulation intact. This is often allophonic, as in the English word *canteen*, with [tʰ] (van de Weijer 2011). In some languages, e.g., Russian, a phonemic contrast may develop between consonants with secondary palatal articulation and their non-palatalized counterparts (e.g., *nʹos* ‘he carried’ vs. *nos* ‘nose’) (see Padgett 2003). The other type involves mutations of velar or alveolar/dental stops to palatoalveolar affricates in the neighborhood of front vowels and palatal glides. These shifts in primary place of articulation are commonly historical, e.g., //k// → /tʃ/ in Slavic and Arabic, but may also have a synchronic status.

This chapter examines two instances of palatalization in Cairene and Baghdadi Arabic, which are classified, respectively, as *phonetic* (coarticulation) and *phonemic* (historical shift). Our discussion of the chronological development of these palatalizations extends across the stages by which sound changes take place, viz., the outset (phonetic) stage, the active (phonological) stage, and the post-active (phonemic) stage (Hyman 1976, Janda 2003). As in the previous chapters, we will explore the featural composition of segmental classes involved in palatalization—its triggers, targets, and outputs. The analysis ends there because neither of the processes under investigation is phonologically active. One must note, however, that “palatalization has played an important role in the development of a feature geometry framework, serving as a testing ground for competing proposals” (Kochetov 2011:1683). In particular, the interaction of consonants and vowels in palatalization has had profound consequences for the Unified Features framework that lies behind the PSM.

## 6.2 Coronal Palatalization in Cairene Arabic

Weak palatalization of coronal stops (henceforth WP) has been noted in the speech of some educated Cairenes. WP is triggered by certain realizations of underlying //i// and targets both plain /t, d/ and emphatic /t<sup>ʕ</sup>, d<sup>ʕ</sup>/. It entails the addition of a secondary place palatal articulation, as in [tʰ] and [dʰ] (Watson 2002:258). This section provides a detailed investigation of the process in an attempt to fill a descriptive gap in the literature on Cairene. By examining the full range of triggers, targets, and potential blockers of WP, I demonstrate how phonetic coarticulation may be distinguished from phonological assimilation. I also explore the hypothesis that WP—characterized as a sound change in progress—has been phonologized in a different sociolect of CA.

Palatalization has been analyzed in a sociolinguistic study by Haeri (1994, 1997), which also includes a phonetic/phonological description. However, no reference is made as to which factors constitute the phonetic versus the phonological correlates. Watson (2002) analyzes the process in autosegmental phonology based on Haeri's generalizations. WP is also briefly mentioned in Badawi (1973), Royal (1985), and Woidich (2006a) as a property of women's speech in Cairo, whereas Skogseth (2000) maintains that it is one of the characteristics that give Egyptian Radio Arabic, i.e., Modern Standard Arabic as spoken by Egyptian radio/TV announcers, its distinctive "Egyptianness".

Given the rarity of data on coronal palatalization, I conducted a fieldwork survey followed by careful examination of the pattern. Four informants were recruited: two personal female acquaintances and two students (a male and a female) selected from an adult class in translation at the American University in Cairo. The informants—all Cairo natives in their twenties and thirties—were asked to read several word lists (which included fillers) carefully prepared to test potential participating segments in WP. Around 200 tokens were recorded in the experiment, and a representative sample of the collected data was analyzed using Praat 5.2.27.

The remainder of this section is organized as follows. Section 6.2.1 discusses the phonetic correlates of WP based on spectrographic evidence. Sections 6.2.2 presents the distributional pattern of Cairene weak palatalization, and argues that it is only a phonetic coarticulatory effect. Section 6.2.3 explores the phonologization hypothesis, and section 6.2.4 addresses the PSM feature specifications relating to palatalization.

### 6.2.1 The Phonetics of Weak Palatalization

Secondary palatalization is defined articulatorily as a raising of the front of the tongue toward the hard palate, as for an [i] vowel, during the articulation of a consonant that has a non-palatal primary articulation (Clark et al. 2007:64). It is often more apparent at the release than during the primary constriction of a consonant (Ladefoged and Maddieson 1996:363). Palatalization of consonants with coronal articulation usually involves the displacement of the tongue, often producing a slightly different primary constriction location (ibid, p.365).

There are two main acoustic cues for palatalized coronal stops when compared to non-palatalized ones. First, the duration of the release noise burst and aspiration is longer. Release duration could approach zero for non-palatalized consonants, whereas it is often prolonged to 60 ms or more for palatalized consonants (Royal 1985:150). Second, the release of palatalized consonants is often more gradual (Haeri 1997:48). Figure 1 shows WP of [tʰ] for one female subject, where the duration of the noise burst between the release of [tʰ] and the Voice Onset Time for the following vowel [i] was measured at 81 ms, clearly visible in the waveform.

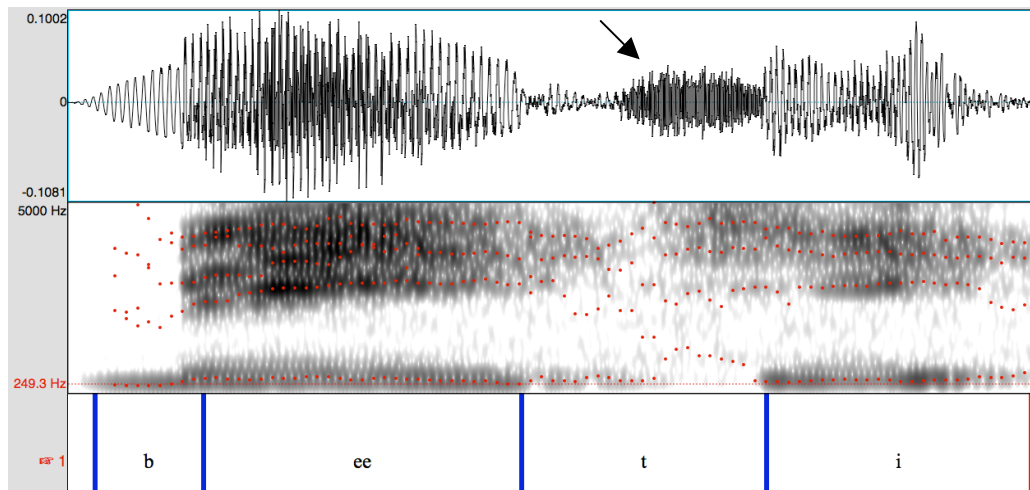


Figure 1. Spectrogram and waveform of the word /beetʰi/ ‘my house’ demonstrating a palatalized coronal stop [tʰ] before word-final /i/ (38-year-old female speaker of CA)

Compare that to the non-palatalized coronal stop [t] in a related word (Figure 2) for which the duration of the release noise burst is only 18 ms for the same speaker. This discrepancy in the behavior of word-final /i/ versus mid /ee/ as triggers of WP is often attributed to their phonetic height (see §6.2.2).

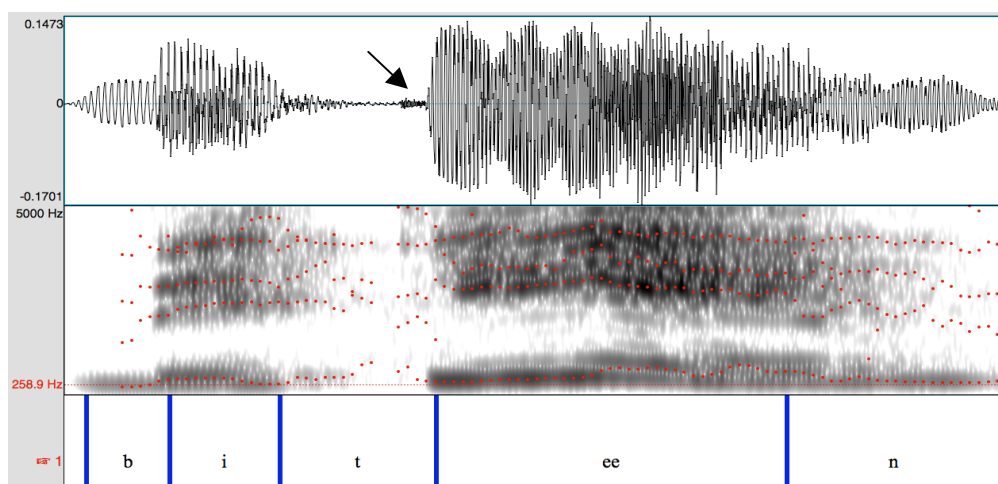


Figure 2. Spectrogram and waveform of the word /biteen/ ‘two houses’ demonstrating a non-palatalized coronal stop [t] before /ee/ (38-year-old female speaker of CA)

For the pharyngealized (emphatic) consonants /t̤/ and /d̤/, palatalization is a little puzzling. While pharyngealized consonants have a backing effect on all adjacent segments, there is an obvious articulatory difficulty in realizing the high front vowel [i] as both fronted and backed. In support of this, Ghazeli (1977) finds that a relatively large F<sub>2</sub> transition characterizes [i] after a pharyngealized consonant, and describes the articulatory gesture underlying the transition as follows:

If the vowel following the pharyngealized consonant is palatal and front [i], the back of the tongue gradually moves forward to achieve the target position of the palatal vowel... it takes longer to move the mass of the tongue to reach the steady state of [i] from a pharyngealized consonant than from its non-pharyngealized counterpart. This difference in distance is translated into a long F<sub>2</sub> transition (p.79).

If we accept this broad interpretation of [i] under pharyngealization, then how could it trigger the palatalization of /t̤/ and /d̤/? The empirical facts lead us to believe that weak palatalization in Cairene targets coronal stops before [i] without regard to their underlying pharyngealization. This has led Haeri (1994, 1997) to suggest that when palatalized, emphatic consonants are articulated with weaker or no pharyngealization (i.e., they are de-pharyngealized) such that they are phonetically indistinguishable from their plain cognates. In the current study, this conclusion is verified by acoustic evidence showing that formant transitions for pharyngealization are covered by the frication noise (see below). Further evidence comes from the “gender complementary distribution” of pharyngealization and palatalization in CA, whereby women display more palatalization, and men more pharyngealization. Female speakers with little or no WP generally show stronger pharyngealization effects when compared to speakers with abundant palatalization. Most women, however, tend to “conceal” pharyngealization by one of two strategies (Royal 1985). One is a *fronting strategy* by which speakers do not place the tongue far enough back in the production of pharyngealized consonants. The other is a *disguising strategy* by which speakers start with the tongue in a backed position for the pharyngealized consonant but accomplish most of the tongue movement forward to the [i] target before the onset of the vowel (p.104).

In addition to the strategic articulatory weakening of pharyngealization, weak palatalization of /t̤/ and /d̤/ also has an impact on their “audible pharyngealization”. Increasing the duration of consonantal noise delays the onset of vowel spontaneous voicing and also decreases the proportion of the F<sub>2</sub> transition that is most robustly indicated during the vowel (cf. Royal 1985:105). The spectrogram and waveform in Figure 3 display WP of /t̤/ in the word [nʊtt̤i], where the release noise duration is 81 ms (cf. Figure 1). In what appears like a masking effect, the turbulent noise portion of the target consonant (marked by the arrow) conceals the F<sub>2</sub> transition to the following vowel, leading to phonetically inaudible pharyngealization.

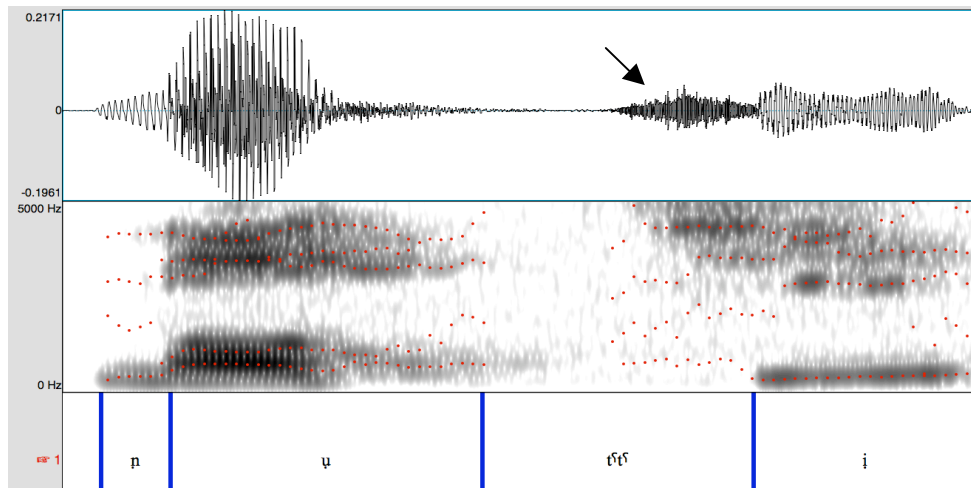


Figure 3. Spectrogram and waveform of the word /nutʃi/ ‘jump FS!’ demonstrating a palatalized coronal stop [tʃ] before word-final /i/ (38-year-old female speaker of CA)

The findings reaffirm Haeri’s observation that upon secondary palatalization of /tʃ/ or /dʃ/, the emphatic character is phonetically suppressed, either partially or completely. However, concealing an acoustic cue does not mean the loss of the corresponding phonological feature unless there is contrastive evidence to that effect. The data in the following section illustrate that WP does not result in the loss of emphasis spread on preceding and following segments.

### 6.2.2 Patterns of Weak Palatalization in CA

Weak palatalization of coronal stops /t, tʃ, d, dʃ/ (singleton and geminate) is triggered by certain realizations of a following high front vowel phoneme; namely the glide /j/, long /i:/, and word-final /i/. It is not triggered by word-internal or epenthetic short /i/. In addition, my informants showed no instance of WP before /ee/ or any other vowel (e.g., front low or back), before another consonant, or before a pause.<sup>3</sup> Note that the effect of emphasis spread from /tʃ/ and /dʃ/ remains on the vowels, as indicated.

First, the palatal glide /j/ always triggers WP of /t, tʃ, d, dʃ/. This takes place within morphemes or across word-boundaries, as exemplified in (1a–b).

#### (1) /j/ as a trigger of WP

- |    |                  |            |                            |                             |
|----|------------------|------------|----------------------------|-----------------------------|
| a. | <i>maɖjʊn</i>    | ‘indebted’ | <i>dʃen</i>                | ‘debt’                      |
|    | <i>ʔixtʃjʌrʃ</i> | ‘choice’   | <i>ʔixtʃarʃ</i>            | ‘he chose’                  |
|    | <i>hʌɖjə</i>     | ‘calm FS’  | <i>ʔahda</i>               | ‘calmer’                    |
|    | <i>fʌɖjə</i>     | ‘empty FS’ | <i>ʔʌɖdʃə</i>              | ‘emptier’                   |
|    | <i>wʌɖjə</i>     | ‘low FS’   | <i>ʔʌwɖtʃə</i>             | ‘lower’                     |
| b. | <i>nʌmit</i>     | <i>but</i> | <i>nʌmitʃ jʌʃni</i>        | ‘she went to sleep, I mean’ |
|    | <i>ʔil-wʌlad</i> | <i>but</i> | <i>ʔil-wʌladʃ jiʔullik</i> | ‘the boy tells you FS’      |

<sup>1</sup> These are contexts claimed by Haeri (1997:58) to trigger palatalization, though quite infrequently.

Long surface /i:/ is always stressed and triggers palatalization across the board. The alternations below show how WP is triggered by /i:/ morpheme internally (2a) or at morpheme boundaries before the plural suffix *-i:n* (2b). This does not apply to word boundaries since no word may start with a vowel in CA.

## (2) /i:/ as a trigger of WP

a.	<i>ʔatʰ'i:l</i>	‘one killed MS’	<i>ʔ'utala</i>	‘ones killed’
	<i>batʰ'i:ʔ</i>	‘slow MS’	<i>butʰ'a:ʔ</i>	‘slow PL’
	<i>tʰ'i:nə</i>	‘mud’	<i>tʰ'əjji:n</i>	‘he daubed with mud’
	<i>badʰ'i:l</i>	‘substitute’	<i>badʰ'a:ji:l</i>	‘substitutes’
	<i>madʰ'i:na</i>	‘city’	<i>m'udun</i>	‘cities’
	<i>nɪdʰ'i:f</i>	‘clean MS’	<i>nɪdʰ'a:f</i>	‘clean PL’
b.	<i>sittʰ-i:n</i>	‘sixty’	<i>s'itta</i>	‘six’
	<i>talatʰ-i:n</i>	‘thirty’	<i>tal'a:ta</i>	‘three’
	<i>məbsutʰ-i:n</i>	‘pleased PL’	<i>məbsʰu:tʰ</i>	‘pleased MS’
	<i>mawqudʰ-i:n</i>	‘present PL’	<i>mawg'u:d</i>	‘present MS’
	<i>ʔadʰ'dʰadʰ-i:n</i>	‘given to biting PL’	<i>ʔadʰ'dʰadʰ</i>	‘given to biting MS’

WP is not triggered by the long mid vowel /ee/ either morpheme-internally or across morpheme boundaries, as shown in (3).

## (3) Lack of WP before /ee/

	<i>tees</i>	‘bull’	<i>tʰeerʰ</i>	‘bird’
	<i>deen</i>	‘debt’	<i>dʰeef</i>	‘guest’
	<i>bint-ʰeen</i>	‘two girls’	<i>xatʰʰ-ʰeen</i>	‘two lines’
	<i>xadd-ʰeen</i>	‘two cheeks’	<i>bitʰʰ-ʰeen</i>	‘two eggs’

Short /i/ triggers WP only when it is word final. In addition to word-final non-suffixal /i/ (e.g., CVCV verbs ending in *-i* as in (4a)), both derivational and inflectional /i/ suffixes trigger the palatalization of preceding coronal stops /t, tʰ, d, dʰ/ for all four speakers (4b–c). Note that word-final vowels in open syllables are never stressed, with the single exception of *di* ‘this’ (Broselow 1976).

## (4) Word-final /i/ as a trigger of WP

a.	<i>w'iʰi</i>	‘he got lower’	<i>witʰ'eet</i>	‘I got lower’
	<i>h'iɖi</i>	‘he calmed down’	<i>hidʰ'eet</i>	‘I calmed down’
	<i>rʰiɖi</i>	‘he became satisfied’	<i>rʰidʰ'eet</i>	‘I became satisfied’
b.	<i>ʔafarʰ'i:ʰi</i>	‘devilish’	<i>ʔafarʰ'i:t</i>	‘devils’
	<i>nabʰ'a:tʰi</i>	‘vegetarian’	<i>nabʰ'a:t</i>	‘plant’
	<i>w'a:tʰi</i>	‘low MS’	<i>w'atʰ'a</i>	‘he lowered’
	<i>ʔ'a:ɖi</i>	‘normal MS’	<i>ʔ'adda</i>	‘he crossed’
	<i>ʔ'a:ɖi</i>	‘judge’	<i>ʔ'adʰ'a</i>	‘he carried out’



c.	<i>b'eet-i</i>	'my house'	<i>b'eet-u</i>	'his house'
	<i>ʃantʔit-i</i>	'my handbag'	<i>ʃantʔa</i>	'handbag'
	<i>xabʔatʔ-i</i>	'you hit FS'	<i>xabʔatʔ-u</i>	'I hit him MS'
	<i>s'i:d-i</i>	'my lord'	<i>s'i:d-u</i>	'his lord'
	<i>ʃ'idd-i</i>	'pull! FS'	<i>ʃ'idd-u</i>	'pull him! MS'
	<i>ʃ'add-i</i>	'bite! FS'	<i>ʃ'add-u</i>	'bite him! MS'

Epenthetic /i/ at both morpheme and word boundaries does not trigger WP.<sup>2</sup> Take the example *xaddʔ* 'he scared' ~ *xaddʔi-ni* 'he scared me', in which the epenthetic /i/ is inserted before the consonant-initial suffix *-ni* to avoid impermissible CCC clusters. Note that stress shifts to the epenthetic /i/ in (5a); thus we know that it is not just a phonetic transition. Similarly, no palatalization is observed when /i/ is inserted at word boundaries, as shown in (5b).

(5) Lack of WP at morpheme and word boundaries before epenthetic /i/

a.	<i>bint'i-na</i>	'our daughter'	<i>ħutʔi-na</i>	'put MS us!'
	<i>xaddʔi-ni</i>	'he scared me'	<i>ʃadd'i-ni</i>	'he pulled me'
b.	<i>bint</i> 'daughter' + <i>l'ajla</i> (name)	→ <i>binti-l'ajla</i>	'Layla's daughter'	
	<i>nutʔ</i> 'jump MS!' + <i>bisʔurʔa</i> 'fast'	→ <i>nutʔi-bisʔurʔa</i>	'jump fast!'	
	<i>midd</i> 'stretch MS!' + <i>bisʔurʔa</i> 'fast'	→ <i>middi-bisʔurʔa</i>	'stretch fast!'	
	<i>xaddʔ</i> 'he scared' + <i>ʔ'ahlu</i> 'his family'	→ <i>xaddʔi-ʔ'ahlu</i>	'he scared his family'	

Non-final /i/ is never a trigger of WP, regardless of stress. Examples of unstressed non-final /i/ include disyllabic words containing /i/ in their second syllable and longer words containing /i/ in their first syllable (6a). Stressed non-final /i/s include monosyllabic words with /i/ nucleus, some disyllabic nouns with initial stress, and verbs that have shifted stress to their penultimate syllable after suffixation (6b). Note that shortening of a long /i:/ trigger results in the loss of palatalization on the subsequent target, whether or not there was stress shift, e.g., *batʔi:χ* 'watermelon' → *batʔiχ-na* 'our watermelon' and *madʔina* 'city' → *madʔint-u* 'his city'.

(6) Lack of WP from unstressed and stressed non-final /i/

a.	<i>t'iktib</i>	'you MS write'	<i>ʃitʔirʔ</i>	'he had breakfast'
	<i>n'idim</i>	'he regretted'	<i>n'idʔif</i>	'he became clean'
	<i>s'atir</i>	'protector'	<i>ħ'idiʔ</i>	'quick-witted'
	<i>tiġ'arʔa</i>	'trade'	<i>tirb'as</i>	'bolt'
	<i>t'ih'i:na</i>	'tahini'	<i>dib'i:ħa</i>	'slaughtered carcass'
	<i>dibb'an</i>	'flies'	<i>diblum'a:si</i>	'diplomat'

<sup>2</sup> The phonetic quality of the epenthetic vowel is variable. While some speakers pronounce it as a lax high front [ɪ], others pronounce it as a lower schwa [ə]. This variation led Haeri (1997), who had a much wider sample of informants, to observe *occasional* weak palatalization across word boundaries, triggered by epenthetic /i/ (p.52).

b.	<i>tibn</i>	‘chopped straw’	<i>dibb</i>	‘bear’
	<i>tʰibb</i>	‘medicine’	<i>dʰiʃf</i>	‘double’
	<i>tʰirmis</i>	‘Egyptian lupine’	<i>tʰiniħ</i>	‘thick-skinned’
	<i>tʰiʃla</i>	‘child FS’	<i>tʰiʃiʃ</i>	‘he came up’
	<i>dʰibla</i>	‘ring’	<i>dʰiʃiʃ</i>	‘he became weak’
	<i>tiktʰib-u</i>	‘you PL write’	<i>nidʰim-na</i>	‘we regretted’

Finally, contrary to the claim that WP is blocked by an adjacent sibilant in a given domain (Haeri 1992:172), my informants showed no sign of such blocking in the syllable or word domain, as shown in (7a–b). Since this blocking effect was explained via dissimilation, I tested words that have different sibilants (including the negation suffix *-j*) both preceding and following the potential targets.

(7) WP with a sibilant in the syllable and word domain

a.	<i>fiʃʰiʃ</i>	‘for nothing’	<i>tʰiʃz</i>	‘buttocks’
	<i>ma-faħattʰiʃ</i>	‘you didn’t cadge’	<i>ma-faʃaʃattʰiʃ</i>	‘you FS didn’t sip’
	<i>ma-fabaʃattʰiʃ</i>	‘you FS didn’t cling’	<i>ma-jʔaddʰiʃ</i>	‘he doesn’t cross’
b.	<i>xabʰas-tʰi</i>	‘you FS baked’	<i>ʔasʰat-tʰi</i>	‘you FS intended’
	<i>ʃiʃʰiʃ-i</i>	‘you FS lived’	<i>wʰiʃʰiʃ-i</i>	‘my waist’
	<i>ʃarʰiʃ-i</i>	‘my condition’	<i>mʰiʃʰiʃ-i</i>	‘my comb’
	<i>ʔaʒʰdʰiʃ-i</i>	‘my intention’	<i>rʰuʒʰdʰiʃ-i</i>	(male name)

Considering the above data, two issues seem to be relevant to the triggers of WP in CA. The first is vowel height. From an articulatory point of view, surface realizations of //i// in Cairene are distinguished by height (Haeri 1994:93). Most importantly, long /i:/ is higher than short /i/ throughout, and word-final /i/ is higher than non-final /i/.<sup>3</sup> Considering that the most favored environment for palatalization is before high front vowels (Kochetov 2011:1672), Haeri argues that vowel height explains the following facts about palatalization: (i) that short /i/ is only a trigger word-finally but not elsewhere; (ii) that /ee/ environments do not trigger WP; and (iii) that long /i:/ and /j/ are triggers regardless of word position. In the current study, F<sub>1</sub> measurements of word-final vs. non-final /i/ show that word-final /i/ is consistently higher than non-final /i/. Epenthetic vowels pattern with non-final /i/ in having a high first formant frequency. These observations denote that the discrepancy in the behavior of weak palatalization triggers is due to their phonetic height in different word positions, rather than their contrastive phonological specifications.

The second issue that may point in the direction of a phonological process is the role of stress and vowel length. WP is triggered by long /i:/ which is always stressed. As mentioned earlier, it is an artifact of CA stress that all long vowels are stressed, while underlyingly long unstressed vowels are subject to shortening. The palatal glide

<sup>3</sup> Mitchell (1956) suggests that /i/ has a tense quality when it is long or word-final, while it is realized as lax [ɪ] elsewhere (p.10).

/j/—which occupies the mora-less syllable onset position—is also a trigger regardless of syllable stress. Short /i/ does not trigger palatalization word-internally, stressed or not; and when it occurs word-finally (always unstressed), it does trigger the process. If we assume that word-final /i/s trigger palatalization because they are unstressed (following Bhat 1978), we would also expect unstressed non-final /i/s to be triggers, which is empirically incorrect. We conclude that stress is an irrelevant factor for WP in CA, and that phonetic height is what actually determines the position of the trigger.

To sum up, WP in Cairene targets the coronal stops /t, tʰ, d, dʰ/, applying across the board (and exclusively) after the palatal glide /j/, long /i:/, and word-final /i/. It is not initiated by the phonetically lower word-internal or epenthetic short /i/ or by the long mid vowel /ee/. Further, palatalization is not blocked by other sibilants in the same domain, and it does not block emphasis spread. In the absence of any phonological testimony (such as lexical exceptions, sensitivity to word-internal structure, opacity effects, etc), then weak palatalization must be considered phonetic (cf. Shahin 2002:47). It is indeed a coarticulatory effect, whereby the articulation of the target consonant is affected by the high and front position of the tongue in the production of the following vowel.

### 6.2.3 The Phonologization of Weak Palatalization

Some uneducated female speakers in Cairo exhibit a “stronger” palatalization in their speech. The process targets the coronal stops /t, tʰ/ and to a lesser extent /d, dʰ/ before specific realizations of the high front vowel //i//, and is blocked by a palatal fricative /ʃ/ in the coda of the same syllable. Strong palatalization, also known as affrication, is defined as a switch in the main place of articulation of the consonant “from apical to post-alveolar”, as in //t// → [tʃ] (Watson 2002:258). Youssef (2010c) contends that strong palatalization is phonological, as opposed to phonetic weak palatalization. But since the current work characterizes the phonology of Cairene as spoken by educated speakers, strong palatalization has not been examined. Nevertheless, the process is relevant from a sound change perspective.

Haeri investigates the hypothesis that palatalization in CA is a sound change in progress. The systematic distribution of weak and strong palatalization according to age, education, and social class supports this hypothesis. She observes that women in Cairo generally have frequent and advanced palatalization (see also Royal 1985:150), and concludes that they are the innovators of this sound change. This replicates findings in many other speech communities that women use the “non-standard” variants of changing variables more frequently than men (Labov 1991).

In trying to answer the question of how recently this sound change took place, Haeri (in the absence of real-time data) makes conclusions based on comparisons of different age groups. Her results show that women above age 50 have no affrication, while in the next (30–50) age group there is a jump to 28% and up to 40% in the youngest age group. These findings suggest that affrication probably did not exist for speakers above age 50 when they were children or adolescent (her data were collected in 1987-1988). In other words, it was not part of the phonology of CA in the 1920s or

1930s. On the other hand, based on observations that the oldest age group has 15% WP, that WP is most salient in the (30–50) age group, and that affrication is replacing it for the youngest age group (see figure 4), Haeri correctly infers that weak palatalization preceded affrication.

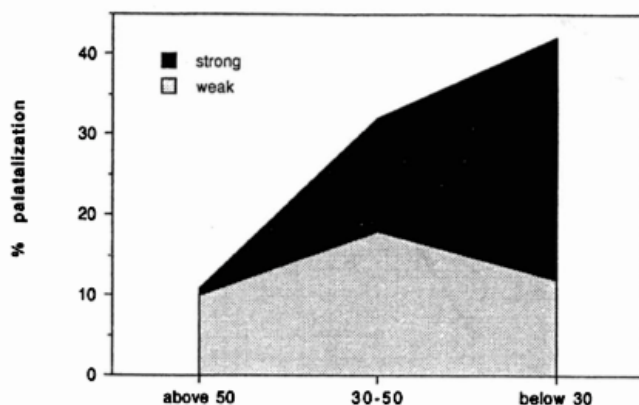


Figure 4: Correlation between frequency of weak and strong palatalization and age (reproduced with permission from Haeri 1994:101)

According to Haeri (1994:100–8), social class and education are among the factors influencing palatalization. WP is clearly exhibited in the speech of highly educated upper and upper-middle class women (29%), which adds to its cosmopolitan and urbane connotations. Affrication, on the other hand, seems to be a feature of less educated lower/middle class women, and this may serve as a partial explanation to its stigmatization (see Geenberg 2011). If WP came in first, as argued above, then it was an innovation of upper/upper-middle class women, whereas affrication is replacing it for women below age 50 who are in the lower/middle classes (Haeri 1994:105). What happened is that women of the latter group have taken a phonetic coarticulatory effect (viz., secondary palatalization) along phonological lines (viz., affrication). But how does such a sound change actually come about?

There is certain agreement among historical linguists that at some point during its active period, a sound change has a phonetic basis (Janda 2003). Thus, sound change occurs as phonetically conditioned variation superseded by speakers' enforcement of phonological and sociolinguistic conditions (ibid.). Hyman (1976:408) introduced the term *phonologization*, whereby over time low-level phonetic variation evolves into phonological patterns. What begins, then, as a predictable byproduct of universal phonetic principles ends up unpredictable. In view of the well-established phonetic motivation for palatalization in coarticulation and auditory misperception (Kochetov 2011:1686), phonological affrication in CA can be understood as arising from sound changes involving these phonetic factors. If upper/upper-middle class women started the phonetic coarticulation of coronal stops to following high vowels, one may think that lower class women (who generally like to imitate what is considered a prestigious sociolect) failed to perceive the exact phonetic environment and so generalized the triggers to other surface forms of underlying //i//, including the phonetically non-high

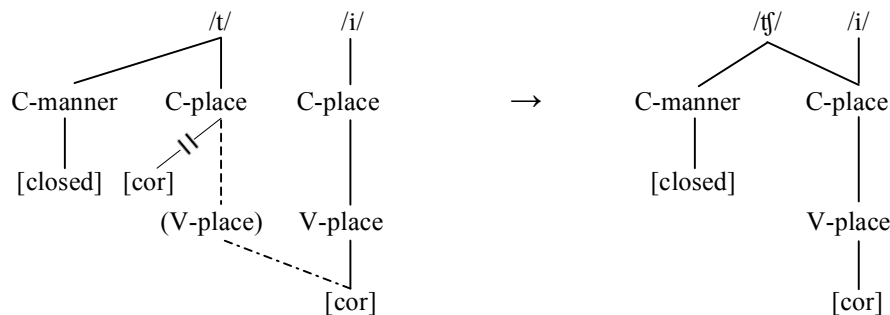
epenthetic vowel and non-final unstressed /i/. We infer that weak palatalization—by virtue of being extended to broader unpredictable contexts—has been phonologized, but remarkably in a different variety of CA.

#### 6.2.4 Features and Representations

The targets of palatalization in Cairene are the coronal stops /t, tʰ, d, dʰ/, which have been characterized by C-place[cor] and C-manner[closed] features. The segments /tʰ, dʰ/ have an additional V-place[dor] and /d, dʰ/ have [voice]. On the other hand, the trigger //i// (regardless of the surface form) is composed of V-place[cor] (see §3.2.3). Weak palatalization is coarticulatory in the sense that target consonants become more similar in place of articulation to the front vowel, i.e., they acquire a palatal quality. If WP were phonological, it would involve the spread of V-place[cor] as a secondary articulation to a consonant whose C-place[cor] feature remains unaltered (cf. Watson 2002:261). I have argued, however, that weakly palatalized consonants in Cairene are only allophonic, and hence these distinctive features do not actively spread.

For expository purposes, affrication (strong palatalization) is illustrated in (8). Assuming that affrication is phonological and assimilatory, there must be something in common between the front vowel trigger /i/ and the palatoalveolar consonants, which are the output of the process (see Lahiri and Evers 1991, Clements and Hume 1995). In this case, both /i/ and /tʃ/ are characterized by V-place[cor]. The process involves the spread of V-place[cor] from the vocalic trigger to a tautosyllabic /t/. The C-place[cor] feature on the target is subsequently delinked, and we end up with an output that has the features V-place[cor] and C-manner[closed], viz., /tʃ/. The latter feature marks the fact that affricates are stops (Clements 1999).

(8) /i/ as trigger of coronal affrication: //ka:tib// → ka:tʃib



To recapitulate, this section confirmed that palatalization in CA is a sound change in progress (Haeri 1994, 1997). It provided acoustic and data-grounded evidence that weak palatalization is a low-level coarticulatory effect, and hence it is not part of the phonology of CA. Next, I considered the idea that WP has been phonologized in another sociolect of CA. Finally, I identified some (non)implications for CA feature geometry which validate already proposed feature specifications.

### 6.3 Velar Palatalization in Baghdadi Arabic

As in many Arabic dialects of bedouin origin, the consonant inventory of Baghdadi contains a voiceless palatoalveolar affricate /tʃ/ (Malaika 1963, Shamdin Agha 1969, inter alia). There is general agreement that this segment has its origin in a process of velar palatalization (also known as *coronalization* or, more commonly, *affrication*), which is the focus of the present section. The palatalization was triggered by front vocoids, which targeted an adjacent voiceless velar stop //k//. This is best understood as spreading of (palatal) V-place[cor] and delinking of (velar) C-place[dor]. However, historical developments are known to divorce phonological rules from their original phonetic motivation (Anderson 1981:520), and this case is no exception. There are numerous occurrences of /k/ where /tʃ/ is expected (and the other way around) if the process were active. We are led to conclude that affrication no longer applies in BA, and that /tʃ/ is an independent phoneme. It is never a contextual variant of input //k//, despite some residual data to that effect. This conclusion is reinforced by a fair number of minimal pairs contrasting /tʃ/ and /k/.

Palatalization of velars in the neighborhood of front non-low vowels is a widely attested sound change that is rooted in phonetics. Articulatorily, there is a mechanical advancement of velar /k/ to a fronter articulation before a palatal vowel or glide. This shift from post-palatal to pre-palatal is then followed by affrication (Cantineau 1960:66). According to Guion (1996), diachronic shifts from a fronted velar to a palatoalveolar affricate develop as a result of perceived acoustic similarity that reflects their strong release frication (see also Ohala 1993).

Affrication was mentioned by the old Arab grammarians, most notably Sibawayh and al-Zamaxšari, as a distinguishing feature for tribes of mid and eastern Arabian Peninsula. It was described as a shift from Old Arabic //k// to /tʃ/ in the contiguity of palatal vowels. The traditional term *kaškaša* referred to an affricated development of the singular feminine enclitic *-ki*, or to the historically unrelated alveolar fricative replacement of it (Holes 1991:671). The change //k// → /tʃ/ was later generalized to other palatal contexts, and in some regions triggered a parallel change //g// → /dʒ/. These affricated reflexes have been typical of eastern/central bedouin dialects ever since (ibid.). Today, they are found in the modern varieties of Qatar (Mustafawi 2006), Abu Dhabi (Qafisheh 1975), Dubai, Kuwait, Bahrain, and Buraimi, which are most of the Eastern Arabic dialects (Johnstone 1963, 1967). Added to these are the bedouin-origin dialects in the Levant and Lower Iraq (Cantineau 1960). Baghdadi Arabic is “partly bedouin” (§1.4.3), and it only underwent the shift from //k// to /tʃ/.

The rest of this section is organized as follows. Section 6.3.1 lays out the distributional patterns of /tʃ/ vs. /k/ in BA, including contrasts, alternations, variation, and full paradigms. Section 6.3.2 provides diachronic and synchronic diagnostics of these patterns. Finally, section 6.3.3 discusses some phonological features, which interact to drive velar affrication. It is not my goal to provide an OT analysis of the process since, I argue, it is only historical.

## 6.3.1 The Distribution of /tʃ/ versus /k/

The contrastive status of /tʃ/ vs. /k/ in BA is established on the basis of minimal pairs (Rahim 1980:249), exemplified in (9a–c). In each of these pairs, the two forms are etymologically related, but the sound shift often coincides with semantic change (Abu-Haidar 1987:48). Thus, /k/ and /tʃ/ are synchronically distinct phonemes.

## (9) Word-initial, medial, and final contrasts involving /tʃ/ vs. /k/

a.	<i>tʃaraz</i>	‘mixed seeds’	<i>karaz</i>	‘cherries’
	<i>tʃala:wi</i>	‘kidneys (culinary)’	<i>kala:wi</i>	‘kidneys (anatomical)’
	<i>tʃu:b</i>	‘tube’	<i>ku:b</i>	‘cup’
	<i>tʃarix</i>	‘wheel’	<i>karix</i>	‘dredging’
	<i>tʃuwa</i>	‘he scorched’	<i>kuwa</i>	‘he ironed’
	<i>tʃa:k</i>	‘base down’	<i>ka:k</i>	‘valve’
b.	<i>ba:tʃir</i>	‘tomorrow’	<i>ba:kir</i>	‘virgin’
	<i>ma:tʃbu:b</i>	‘stretched out’	<i>makbu:b</i>	‘spilt’
	<i>ma:tʃammal</i>	‘complete’	<i>mkammal</i>	‘someone who is perfect’
	<i>ma:tʃattaf</i>	‘with crossed arms’	<i>mkattaf</i>	‘fettered’
c.	<i>ʃimlitʃ</i>	‘he marries’	<i>ʃimlik</i>	‘he possesses’
	<i>ʃuratʃ</i>	‘brushes’	<i>ʃurak</i>	‘he rubbed’
	<i>da:tʃtʃ</i>	‘he filled to the brim’	<i>dakk</i>	‘he leveled’
	<i>fa:tʃtʃ</i>	‘jaw’	<i>fakk</i>	‘he opened’

In what appears like a trace of a diachronic change, three lexemes exhibit alternations between /tʃ/ and /k/ in semantically-related forms of the same root (Abu-Haidar 1987:48), as shown in (10). These alternations have led to claims that the voiceless affricate /tʃ/ may be the output of underlying //k// in BA synchronic grammar in addition to being a distinct phoneme. This is usually assumed to be triggered by adjacency to the front vowels (Altoma 1969:13). However, the rarity of the alternations and the high frequency of the /tʃ/ forms suggest that they have been lexicalized in BA (see §6.3.2).

## (10) Alternations between /tʃ/ and /k/ within forms of the same root

a.	<i>tʃa:n</i>	‘he was’	<i>tʃinit</i>	‘I was’	<i>but</i>
	<i>ʃku:n</i>	‘he is’	<i>?aku:n</i>	‘I am’	
	<i>kawwan</i>	‘he created’	<i>muka:n</i>	‘place’	
b.	<i>tʃibir</i>	‘big MS’	<i>tʃibira</i>	‘big FS’	<i>but</i>
	<i>kbar</i>	‘big PL’	<i>?akbar</i>	‘bigger’	
	<i>kubar</i>	‘he grew’	<i>kubur</i>	‘size’	
c.	<i>tʃilma</i>	‘word’	<i>tʃilam</i>	‘words’	<i>but</i>
	<i>kallam</i>	‘he spoke with’	<i>kalam</i>	‘speech’	

There exist a large number of words in Baghdadi Arabic (both native and loans) that surface invariably with the affricate /tʃ/, as in (11a), even in the proximity of back vowels. Although, historically, some words have been derived from //k// in the right environment, it seems that affrication has been regularized inside of each paradigm (Cantineau 1960:66). Johnstone (1963:220–2) argues that velar affrication in Eastern Arabic was a historical process that no longer applies, and maintains that /tʃ/ should be considered a phoneme in its own right, rather than being a realization of //k//. Of importance also are words (native and loans) that surface invariably with the velar /k/ (11b), even when contiguous to front vowels (*ibid.*, p.219–20). The non-occurrence of /tʃ/ in these paradigms indicates that affrication is not productive in the language.

## (11) Non-alternating /tʃ/ and /k/ paradigms

a.	<i>tatʃʃa</i>	‘he leaned’	<i>tatʃwa</i>	‘prop, support’
	<i>ʃa:dir</i>	‘tent’	<i>ʃwa:dir</i>	‘tents’
	<i>fatʃʃ</i>	‘jaw’	<i>ʃʃu:ʃ</i>	‘jaws’
	<i>mʃa:ʃi:l</i>	‘slings’	<i>miʃʃa:l</i>	‘sling’
	<i>riʃʃi:ʃ</i>	‘weak’	<i>ratʃʃ</i>	‘he became weak’
	<i>ʃʃiŋqɑ:lʃ</i>	‘hook’	<i>ʃʃaŋqɑ:lʃ</i>	‘he hooked together’
b.	<i>sikan</i>	‘he resided’	<i>sa:kin</i>	‘resident’
	<i>makkan</i>	‘he enabled’	<i>mumkin</i>	‘possible’
	<i>dukkɑ:n</i>	‘shop’	<i>dka:ki:n</i>	‘shops’
	<i>maki:na</i>	‘machine’	<i>maka:jin</i>	‘machines’
	<i>tanaka</i>	‘piece of tin’	<i>tanaktʃi</i>	‘tinsmith’
	<i>turkja</i>	‘Turkey’	<i>turki</i>	‘Turkish’

The extreme irregularity of the pattern is coupled with some degree of inter-speaker variation between /k/ and /tʃ/ (Abdul-Hassan 1988:190), as shown in (12). However, a single variant is consistent throughout the paradigm. The forms with /k/ are borrowed from Standard Arabic, and are becoming increasingly common. Full-fledged optionality of this type implies two separate underlying forms, as opposed to an alternation.

## (12) Variation between /tʃ/ and /k/ in some words

<i>ʃʃalib / kalib</i>	‘dog’	<i>ʃʃitif / kitif</i>	‘shoulder’
<i>ʃʃis / kis</i>	‘bag’	<i>ʃʃalatʃ / kalak</i>	‘a raft of inflated skin’
<i>ʃʃibas / kibas</i>	‘he packed’	<i>ʃʃarraʃ / karraʃ</i>	‘he gulped down’
<i>ʃʃam / kam</i>	‘how many?’	<i>liʃʃam / likam</i>	‘he punched’
<i>dabʃʃa / dabka</i>	‘a Lebanese dance’	<i>ʃʃibba:ʃ / ʃʃibba:k</i>	‘window’
<i>siʃʃʃi:n / sikki:n</i>	‘knife’	<i>siʃʃʃa / sikka</i>	‘mold’

Perhaps the hallmark of *kaʃkaʃa* in the Arabic linguistic tradition is the use of /tʃ/ as the reflex of the second person feminine singular object and possessive pronouns, as shown in (13a–b). The suffix takes the form /tʃ/ post-vocally (whether it follows a



front or a back vowel) and /tʃ/ post-consonantly, and the corresponding masculine suffix is /k/ and /ak/, respectively (Erwin 1963:272). Although this /tʃ/ is historically a palatalized pausal variant of *-ki*, it can in no circumstances be replaced by /k/, and thus it is not properly speaking a variant of /k/ at all (Johnstone 1963:222).

(13) Non-alternating /tʃ/ in second person feminine pronouns

a.	<i>ʔabu:-tʃ</i>	‘your FS father’	<i>ʔaxu:-tʃ</i>	‘your FS brother’
	<i>beet-itʃ</i>	‘your FS house’	<i>nafs-itʃ</i>	‘yourself FS’
b.	<i>xalla:-tʃ</i>	‘he let you FS’	<i>jinsa:-tʃ</i>	‘he forgets you FS’
	<i>ʃa:f-itʃ</i>	‘he saw you FS’	<i>xawf-itʃ</i>	‘he frightened you FS’
	<i>bi:-tʃ</i>	‘with you FS’	<i>ʃalee-tʃ</i>	‘on you FS’

In this section, I showed that /tʃ/ and /k/ are separate phonemes in Baghdadi which contrast in a number of minimal pairs. The few alternations in which the two sounds exist are argued to be lexicalized. Further evidence for the phonemic position and the unproductiveness of velar affrication comes from the full paradigms with /tʃ/ or /k/, which simply ignore the occurrence/non-occurrence of palatalization contexts. Some explanations of these facts are given underneath.

### 6.3.2 Diagnostics of Velar Affrication in BA

In Baghdadi, /tʃ/ is a fully-fledged contrastive phoneme. Historically, it developed from Old Arabic //k// via a process of affrication in the contiguity of front high vowels. As an urban *gilit*-dialect, BA was subject to the conditioned affrication of //k// to /tʃ/, while //g// was not affricated to /dʒ/ before front vowels as is the case in the neighboring bedouin *gilit*-dialects of Iraq and the Persian Gulf (Jastrow 1980: 142–3).<sup>4</sup> Holes (1991) proposes that this sound change took place no later, and possibly earlier than the mid 13<sup>th</sup> century, the period around which Baghdad began to be repopulated by bedouin speakers following the Mongol sack of the city in 1258. The new immigrants did not suppress the affricated reflex of /k/ nor the phonetically unconditioned use of *-tʃ* as a feminine enclitic, and in the course of time these were adopted by the urban Muslim speakers as well (Heikki 2009:37).

The phonemic status of the coronal affricate /tʃ/ was established when it was used as the only variant of the second person feminine suffix (see Mustafawi 2006:23). It is traditionally assumed that the sound change developed to maintain the distinction between the second person singular masculine /ka/ and feminine /ki/ in pre-pausal position, since pausal short-vowel deletion would conflate them into /k/. The gender distinction argument is refuted by Holes (1991), who points out that gender redundancy in Arabic verb morphology was reduced by dropping the OA final /a/ from the second person subject masculine *-ta* and retaining the final /i/ of the feminine *-ti* (as

<sup>4</sup> However, in a few BA words the affricated /dʒ/ has been adopted as an established form, e.g., *rifi:dʒ* ‘friend’, *dʒidir* ‘pot’, *ba:b if-farʒi* ‘the East Gate (quarter)’, but: *ʃarqi* ‘eastern’ (Blanc 1964:27).

in *dazee-t* / *dazee-ti* ‘you MS/FS sent’). The same reductional change, namely, OA *-ka* (2MS) / *-ki* (2FS) → BA *-k* (2MS) / *-ki* (2FS), would have maintained the gender opposition in the enclitic system. Indeed, this is the pattern found in post-vocalic position in many urban dialects of Arabic (e.g., in Damascus, Jerusalem, and Cairo). Hence, it is asserted that the motivation for *kaškaša* is phonological, rather than morphological. First, Old Arabic //k// was fronted and affricated in high front vowel environments, and subsequently /tʃ/ was generalized to all positions in which this suffix occurred (ibid., p.659–60).

Upon the introduction of the affricated feminine enclitic, there must have been a stage when //k// was systematically phonologized to /tʃ/ in all palatal environments. The new phonological rule resulted in abundant /k~/~tʃ/ alternations, e.g., between a singular form that exhibits affrication and a cognate broken plural form that lacks the triggering context because of internal stem modifications. These were accompanied by an increasing number of lexical exceptions. *Lexicalization* came in as specific morphemes had to be marked as undergoing versus not undergoing the alternation (Hyman 2008:398). This is when the affricate /tʃ/ acquired a contrastive phonemic status, reinforced by the integration of loanwords that include this segment and by non-alternating cases of /k/ and /tʃ/ within paradigms (as in (11) above). At this stage, the variants have become part of the set of arbitrary sound-meaning pairings that distinguish different words such as the minimal pairs in (9) (see also Hall 2007:10). The original rule has been lost entirely.

It follows that the rare alternations in (10) are nothing but relics of the original rule. They can be explained as instances of *weak suppletion* whereby forms related paradigmatically are expressed with some unpredictable differences in their phonological components (see Juge 1999). These “irregular” forms commonly have a high frequency of occurrence, which grants them some autonomy (Bybee 1985:88). This is a criterion that certainly applies to the affricated forms in (10a–c)—glossed as ‘was’, ‘big’, and ‘word’. And just like the adoption of the phonetically unconditioned *-tʃ* as a feminine suffix versus the non-affricated masculine suffix *-k*, native speakers of BA seem to have memorized the surface occurrences of /tʃ/ and /k/ in certain lexical items. I argue that synchronically //tʃ// and //k// are independent underlying phonemes, and items containing one or the other have to be specified in the lexicon as such.

In order to account for the cases of free variation between /k/ with /tʃ/ in BA (11), we have to consider some historical and sociolinguistic factors. First, it is assumed that all such forms were pronounced with the affricated variant, after which a /tʃ/ → /k/ shift was initiated, and this coincided with recent population movement and rapid urbanization in Baghdad. The shift was not efficient enough to overcome the variation (but see Heikki 2009:26).<sup>5</sup> Today, forms with /tʃ/ are more frequent in older than in younger people’s speech (Abu-Haidar 1987:47). And it appears that the use of /tʃ/ became stigmatized as a bedouin feature, whereas shifting to /k/ was interpreted as a

<sup>5</sup> More substantial regression in the use of the affricated form (and even potential obsolescence) has been observed in urban dialects of the Arabian Peninsula (see e.g., Al-Azraqi 2007).

sign of urbanization, social status, and education. These elements often go hand in hand with the growing influence of Standard Arabic in a diglossic context. The present situation with regard to the /tʃ/ → /k/ shift seems to be fairly stable (*ibid.*, p.55), and synchronically it is safe to assume two underlying forms, //tʃ// and //k//.

In sum, the affricate /tʃ/ developed diachronically from underlying //k// in palatal contexts. I investigated the historical development of this sound change, and argued that alternations that were once phonologically predictable eventually became lexicalized. In other words, /tʃ/ is no longer a contextual variant of /k/ in BA, but a distinct phoneme. A few residual alternations were explained in terms of weak suppletion. On the other hand, cases of variation and the recent tendency toward using /k/-forms were shown to be motivated by extra-linguistic, namely sociolinguistic, factors.

### 6.3.3 Features and Representations

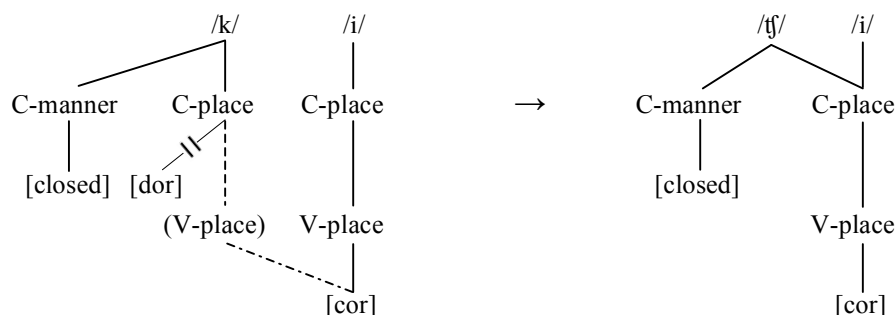
Although affrication does not apply synchronically in BA, the historical development of the process offers important clues about certain natural classes of segments in the language and the distinctive features involved in their classification. In section 3.3.3, I have argued that the high front vowel /i(:)/ and the palatal glide /j/ are composed of a single V-place[cor] feature. If affrication is to be considered a type of place assimilation that was once motivated by these segments, then the output of the process, viz., /tʃ/, must also have that feature (but see Watson and Dickins 1999 for an alternative proposal). This conclusion is independently supported by two other aspects of the grammar. First, /tʃ/ is necessarily [coronal] because it triggers the assimilation of the definite article (§2.3.1.1). Second, /tʃ/ is classified with the high front vowel and other palatal consonants as a blocker of ES (§3.3.2.2). The latter natural class is marked by V-place[cor], which is phonetically antagonistic to the emphatic feature.

On the other hand, the affricates /tʃ/ and /dʒ/ are the outputs of a merge between a coronal stop /t, tʰ, d/ and a following palatoalveolar fricative /ʃ/ (§2.3.2.3). This raises the question as to whether BA affricates should be interpreted as realizations of two successive phonemes (i.e., /tʃ/ = //t// + //ʃ// and /dʒ/ = //d// + //ʒ//) or as realizations of single phonemes. Phonologically, affricates are argued to be simple stops bearing no fricative features; i.e., they have C-manner[closed] (see Clements 1999). With regard to Baghdadi Arabic, valuable evidence comes from phonotactics and noncommutivity (Rahim 1980:209–11). On the one hand, BA does not permit consonant clusters of more than two, and so a word like *tʃru:x* ‘wheels’ cannot be deemed as having three initial consonants. On the other hand, given that /tʃ/ and /dʒ/ form a pair differing only with respect to [voice], they should have comparable phonological status in the language. /dʒ/ must be interpreted as a single (contour) segment, given that a potential /ʒ/ component never occurs independently in BA in any other position. It follows that /tʃ/ should also be interpreted as a contour segment.

The process has been characterized as a change of velars to coronals triggered by strictly adjacent high front vocoids (most likely in the stem domain). The diachronic shift from //k// to /tʃ/ in the context of a trigger /i/ is handled autosegmentally in (14). V-place[cor] spreads from the trigger to the velar stop in which the V-place node is

supplied by interpolation (cf. Lahiri and Evers 1991:90–1). At the same time, the C-place[dor] feature of the target is delinked, whereas C-manner[closed] remains intact. The PSM requires no *tier promotion* whereby the [coronal] feature is copied under the C-place node to replace the original [dorsal] feature (see Clements 1991:100, Clements and Hume 1995:295). Instead, V-place[cor] and C-manner[closed] simply give rise to a coronal affricate output, namely /tʃ/, which is preferred over an articulatorily marked palatal stop.<sup>6</sup> Whether or not velar affrication is blocked in the scope of emphatic segments has not been verified for BA.

(14) /i/ as trigger of (historical) velar affrication: //kibi:r// → tʃibi:r



These autosegmental representations are consistent with both the phonetic characteristics and the phonological patterning of the concerned segments. The assimilatory nature of affrication is captured by the theory-specific assumption that a feature such as V-place[cor] is applicable to vowels and consonants alike (see Kochetov 2011, §4.2–4.3 and references therein). The above interactions are believed to have applied during the active period of velar affrication, that is, before the alternations became lexicalized. They point toward a phonologically-motivated instance of palatalization in the history of BA.

## 6.4 Conclusion

This chapter examined two cases of palatalization in Cairene and Baghdadi Arabic, both elicited by high front vowels. Palatalization in CA targets coronal stops which acquire a secondary articulation, whereas in BA it targets velar //k// which turns into a palatoalveolar affricate /tʃ/. A fundamental issue for a study of palatalization is *when* it may actually be considered part of the phonology of a language, and thus in need of a theoretical account. I showed that neither of the above processes is phonologically active: one is phonetic but may have been phonologized in another variety of CA, while the other has a lexicalized status (in BA). These characterizations reflect the development of sound change, from phonetics to phonology to the lexicon.

<sup>6</sup> In some languages, e.g., modern Romance (Calabrese 1993), there is evidence for an intermediate stage during which a secondary “palatal” feature is assigned to the velar stop, as in /kʲ/. Later on, these palatalized velars are simplified by delinking their primary [dorsal] and concomitant affrication to /tʃ/.

# CHAPTER 7

## Conclusions

This thesis has demonstrated that a study of any one segmental phenomenon requires a detailed consideration of the contrastive patterns of individual languages. The focus has been on processes of place assimilation, which are defined autosegmentally as the sharing of a place of articulation feature between two or more segments. In view of the well-known inadequacies in the synchronic descriptions of Arabic dialects, I hope to have provided a complete and accurate characterization of these phenomena in the Cairene and Baghdadi varieties, verifying whether a given alternation is phonological or not and solving some long-standing analytical challenges.

In analyzing these phenomena, I adopted a representational approach in which the phonological behavior of segments is the primary factor in determining their feature specifications—following the Toronto School of Contrast. From an acquisition perspective, features are viewed as abstract categories that “emerge” from language-internal patterns (Mielke 2008); i.e., they are neither universal nor genetically predetermined. Within theories of feature geometry, these features are grouped into sets or classes that are organized in a hierarchical structure, via intervening class nodes (Uffmann 2011:647). This has allowed us to speak of constituents such as the *place node*, under which processes of place assimilation may take place.

The analysis has been formalized within the framework of the Parallel Structures Model of feature geometry (Morén 2003, 2006, 2007a, inter alia). This is a model that operates only on language-specific contrastive features, exploits featural and structural combinations to the greatest extent possible, gives a unified account of consonant-vowel interactions, considers any phonological process in light of the complete sound system, and underlines the role of representations in constraint-based analyses. Tables (1) and (2) below sum up the PSM feature specifications for Cairene and Baghdadi Arabic sound systems. For completeness’ sake, I provided both the underlying and/or surface forms of each segment. The check mark “✓” indicates a specification of a privative feature, and shaded cells indicate simplex segments that are composed of single features.

7. CONCLUSIONS

(1) Cairene Arabic PSM Feature Geometry

			C-PLACE			V-PLACE			C-MANNER		V-MANNER	LARYNGEAL
	UR	SR	lab	cor	dor	lab	cor	dor	closed	open	open	voice
Mannerless	//l//	/l/		✓								
	//q//	/q/			✓							
Stop	//ʔ//	/ʔ/							✓			
	//b//	/b/	✓						✓			
	//t//	/t/		✓					✓			
	//d//	/d/		✓					✓			✓
	//t̪//	/t̪/		✓				✓	✓			
	//d̪//	/d̪/		✓				✓	✓			✓
	—	/tʃ/					✓		✓			
	—	/dʒ/					✓		✓			✓
	//k//	/k/			✓				✓			
//g//	/g/			✓				✓			✓	
Continuant	//h//	/h/								✓		
	//f//	/f/	✓						✓			
	//v//	/v/	✓						✓			✓
	//s//	/s/		✓					✓			
	//z//	/z/		✓					✓			✓
	//sˤ//	/sˤ/		✓				✓	✓			
	//zˤ//	/zˤ/		✓				✓	✓			✓
	//ʃ//	/ʃ/					✓		✓			
	//ʒ//	/ʒ/					✓		✓			✓
	//x//	/x/			✓				✓			
	//χ//	/χ/			✓				✓			✓
Approximant	//n//	/n/							✓	✓		
	—	/ŋ/			✓				✓	✓		
	—	/ɲ/					✓		✓	✓		
	//m//	/m/	✓						✓	✓		
	//r//	/r/		✓					✓	✓		
	//rˤ//	/rˤ/		✓				✓	✓	✓		
	//ħ//	/ħ/							✓	✓		
	//ʕ//	/ʕ/							✓	✓		✓
Vowel	//a//	/a/									✓	
	//ɑ//	/ɑ/						✓				
	//i//	/i/					✓					
	—	/ee/					✓				✓	
	//u//	/u/				✓						
	—	/oo/				✓					✓	

## (2) Baghdadi Arabic PSM Feature Geometry

			C-PLACE			V-PLACE			C-MANNER		V-MANNER	LARYNGEAL
	UR	SR	lab	cor	dor	lab	cor	dor	closed	open	open	voice
Mannerless	//p//	/p/	✓									
	//b//	/b/	✓									✓
	//θ//	/θ/		✓								
	//ð//	/ð/		✓								✓
	//ðˤ//	/ðˤ/		✓				✓				✓
	//q//	/q/			✓							
Stop	//ʔ//	/ʔ/							✓			
	//t//	/t/		✓					✓			
	//d//	/d/		✓					✓			✓
	//t̪//	/t̪/		✓				✓	✓			
	//t̪ˤ//	/t̪ˤ/					✓		✓			
	//ɖ//	/ɖ/					✓		✓			✓
	//k//	/k/			✓				✓			
	//g//	/g/			✓				✓			✓
Continuant	//h//	/h/								✓		
	//f//	/f/	✓							✓		
	//s//	/s/		✓						✓		
	//z//	/z/		✓						✓		✓
	//sˤ//	/sˤ/		✓				✓		✓		
	//ʃ//	/ʃ/					✓			✓		
	—	/ʒ/					✓			✓		✓
	//x//	/x/			✓					✓		
	//χ//	/χ/			✓					✓		✓
Approximant	//n//	/n/							✓	✓		
	—	/ŋ/			✓				✓	✓		
	—	/i̯/					✓		✓	✓		
	//m//	/m/	✓						✓	✓		
	//l//	/l/		✓					✓	✓		
	//l̪//	/l̪/		✓				✓	✓	✓		
	//r//	/r/		✓	✓				✓	✓		
	//ħ//	/ħ/								✓	✓	
	//ʕ//	/ʕ/								✓	✓	✓
Vowel	//a//	/a/									✓	
	//ɑ//	/ɑ/						✓				
	//i//	/i/					✓					
	—	/ee/					✓				✓	
	//u//	/u/				✓		/✓/				
	—	/oo/				✓					✓	

From the outset, I have maintained a strict division of labor between phonology and phonetics: phonology being concerned with the system of contrastive relations within a given language, and phonetics with the physical characteristics of speech sounds. Accordingly, there is no reason for a feature to be active in a particular grammar unless there is overt phonological evidence for its existence (Clements 2001). An example is the conspicuous absence of a V-manner[closed] feature in the grammars of CA and BA. Moreover, we need only indicate distinctive feature specifications for each segment, and the result of this is usually not a mirror of the phonetic facts. For instance, the segments /ʔ/ and /h/ are phonetically glottal, but they display no positive evidence for a place feature in CA and BA. It follows from this that two phonetically similar segments (in two languages) could be analyzed into features in a number of different ways for the purposes of phonology. This pertains to the consonants /b, l, r/ in CA vs. BA (cf. Bellem 2007:324). Even though we do not expect identity between languages with respect to the featural composition of particular segments, we do find overwhelming similarity due to the universal phonetic properties of speech sounds.

I have also argued, in line with the generative tradition, that the representational machinery of the grammar should be as economical as possible. The advocated PSM implements economy on two levels. One is feature economy (à la Clements 2003), whereby languages tend to exhaust the combinatory potential of a small number of features across their inventories. Here, only ten contrastive features—under the nodes C-place, V-place, C-manner, V-manner, and Laryngeal—cross-classify the large inventories of Cairene and Baghdadi, with the major class features being replaced by various combinations of [open] and [closed]. The other level is structural economy, whereby every complex structure in a given inventory entails a less complex structure (Morén 2006:1212). A good example is the four-feature complex segment /r<sup>s</sup>/ in CA, which coexists with ten segments that have different subsets of its structure, namely /ɑ, ʔ, h, l, r, n, t, t̤, s, s<sup>s</sup>/. A more straightforward example is the representation of mid vowels (in chapter 5) as merger of the features for high and low vowels.

One of the principal concerns of this dissertation has been to explain the interplay between consonants and vowels in autosegmental theory. It was Clements' (1991) proposal that consonants and vowels use the same place features that inspired the PSM. The idea was to develop a more restrictive model where consonants and vowels have similar representations for place, manner, and laryngeal articulations. Throughout the thesis, this architecture has allowed a principled and unified analysis of C-V interactions. More specifically, the claim that consonants can have V-class features has been central to the analysis of emphasis spread (chapter 3), in which a V-place [dor] feature of an emphatic consonant or vowel spreads to adjacent consonants and vowels. On the other hand, the claim that features can spread from a C-node to a V-node (given that vowels cannot have C-class features) has offered a solution to BA labialization (§4.3), where C-place[lab] and C-place[dor] spread from consonants to a V-place node on an adjacent vowel. Solving these puzzles is not only of theoretical value, but is also an important step toward a comprehensive analysis of a language's segment inventory.



This dissertation has given a single, coherent analysis of all place assimilation facts within each language variety. I have shown that an explanation of phonological activity in one small part of a language is dependent on the structure of the entire sound system of that language. It is important to look at languages holistically when analyzing particular phenomena because there are often unexpected relationships among processes that can make or break analyses designed to account for a single phenomenon. Many cursory accounts of place assimilations in Arabic dialects are plausible but simply do not work when combined with a more complete phonological analysis of the language. The PSM, almost by default, forces us to look more carefully at a wide range of phonetic details and (morpho-) phonological alternations in individual languages and to take into account the fine interactions between different processes. In the foregoing chapters, we have seen how these factors jointly yield consistent feature specifications and constraint rankings for the language in question.

In explaining the empirical facts, I employed the formal mechanism of constraint ranking in Optimality Theory (Prince and Smolensky 1993/2004). However, contrary to the spirit of orthodox OT, I have asserted that (language-specific) segment-internal representations are an indispensable ingredient in candidate generation and constraint formulation—admitting only structurally-sound candidates and constraints into the grammar. Place assimilation is simply derived by ranking a “pro-spreading” markedness constraint, such as ALIGN [F], above an “anti-spreading” faithfulness constraint, such as DEPLINK [F]. Considering that all segmental constraints act to either allow or disallow certain types of feature geometric structure, we are in a position to reclaim McCarthy’s (1988:84) dictum: “if the representations are right, then the [constraints] will follow”.

In conclusion, this thesis has presented a detailed and uniform account of various processes of place assimilation in Cairene and Baghdadi Arabic. What has emerged is an ever-clearer picture of the complete segmental phonologies of these closely-related varieties. Several analytical solutions have been proposed, which are model specific or even principle specific. And I have demonstrated that a restrictive and emergentist model such as the PSM attains a succinct and accurate characterization of the phonological grammar and promises a wider empirical coverage than previous proposals. Meanwhile, the findings of this thesis have some far-reaching theoretical implications, mainly concerning the role of universality and the OT concept of factorial typology in a system of emergent, language-specific features and constraints. These open issues are left for future research.



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وَمِنْ آيَاتِهِ خَلْقَ السَّمَوَاتِ وَالْأَرْضِ وَأَخْلَافَ اللَّيْسَانِ كُمْ

وَالْوَيْكُمُ إِنَّ فِي ذَلِكَ لَآيَاتٍ لِّلْعَالَمِينَ ﴿٢٢﴾

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