Labialization in Cairene Arabic

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Abstract

This paper investigates certain morphological categories in Cairene Arabic where the contrast between the short high vowels [i] and [u] is neutralized. The understanding of these neutralizations has direct consequences on the featural composition of different classes of segments. The analysis is formulated in the framework of the Parallel Structures Model of feature geometry, first introduced in Morén (2003, 2006, 2007) and further developed in work at CASTL. Assuming that features are language-specific but also articulatorily based, I motivate feature specifications for each participating segment and offer a straightforward autosegmental analysis of the distribution. The proposed analysis fits neatly into a constraint-based model and supports the growing body of literature claiming that representations are important even to optimality-theoretic analyses.

1. Introduction

Cairene Arabic (CA) exhibits a process of "vocalic labialization" (also known as "rounding") 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 the guttural consonants [ʔ, h, ħ, ʕ]. These partial neutralizations offer some evidence for the 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 to a C- or a V- node.

The discussion is organized as follows. By way of introduction, section 2 provides an overview of CA consonant and vowel inventory, then section 3 presents the relevant data (elicited from two female native speakers of CA) and distributional patterns. Section 4 gives the featural composition and autosegmental representations of the participating segments. Section 5 develops an OT analysis that accounts for the assimilation patterns, and section 6 outlines some conclusions.

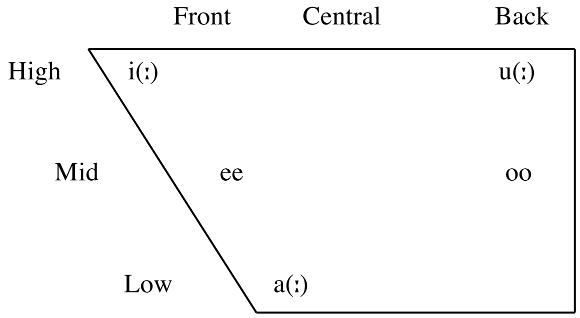
2. The surface inventory of Cairene Arabic

The charts in (1) and (2) show the surface inventory of CA consonants and vowels respectively, and their articulatory descriptions.

(1) *Chart showing 29 surface consonants in CA*

	Bilabial		Dental		Palatal		Velar		Uvular	Pharyngeal		Glottal
Stop		b	t tˤ	d dˤ			k	g	q			ʔ
Fricative	f	v	s sˤ	z zˤ	ʃ	ʒ	x	ɣ		ħ	ʕ	h
Nasal		m		n								
Lateral				l								
Trill				r rˤ								
Glide		w				j						

(2) *Chart showing 8 surface vowel monophthongs in CA*



3. Labialization within Nouns, Verbs, 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, an /i/ stem vowel surfaces as [u] after initial [w], but the process has been described as optional (Woidich 2006:20). 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 (3a–b), it may apply to nouns and verbs within some phonological phrase but not in citation form. The trigger must be word-initial.

(3) *Labialization following word-initial [w] in nouns, adjectives & verbs*

a.	*wist*	‘middle’	*wust i l-balad*	‘downtown’
	wirk	‘thigh’	*ʔidi:ni l-wurk*	‘give me the thigh (chicken)’
	wirs	‘inheritance’	*xad il-beet wurs*	‘he inherited the house’
	wing	‘wing (football)’	*ʔil-wung iʃʃima:l*	‘the left wing’
	widn	‘ear’	*wudn i kbi:ra*	‘a big ear’
	wila:da	‘birth’	*fi l-wula:da*	‘in labor’
b.	*wiliʕ*	‘it caught fire’	*ʔ̣ịṇ-ṇạrˤ wulʕit fi:*	‘he caught fire’
	wiʔif	‘he stood’	*wuʔif sa:bit*	‘he stood still’
	ẉịsˤịḷ	‘he arrived’	*ẉụsˤịḷ badri*	‘he arrived early’
	ẉịtˤị	‘it decreased’	*sọọtụ ẉụtˤị*	‘his voice became quieter’
	wisiʕ	‘it widened’	*ʔig-gazma wusʕit*	‘the shoe became too wide’
	wizin	‘he weighed’	*wuznit kilu ruzz*	‘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 Arabic in both slow and fast speech. The set of data in (4) 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 Youssef 2010) where a glide replaces C_2 of the defective root; and we get the pattern CaWCa. By examining *sound* roots (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_2, as in *gizam* and *firad.*

(4) *Labialization preceding non-word-initial [w]*

singular	*plural*	*gloss*
ʕ̣ọọdˤạ	*ʕ̣ụẉạdˤ*	‘rooms’
ḳọọrˤạ	*ḳụẉạrˤ*	‘balls’
tooka	*tuwak*	‘hairpins’
sˤọọḅạ	*sˤụẉạḅ*	‘greenhouses’

kooʃa	*kuwaʃ*	‘wedding daises’
kooma	*kuwam*	‘piles’
nooba	*nuwab*	‘fits’
f̣ụːtˤạ	*f̣ụẉạtˤ*	‘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 or laryngeal consonant [ʔ, h, ħ, ʕ], as shown in (5a–b) respectively. 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). And even when the vowel is phonetically reduced, it keeps its original distinctive ‘color’.

(5) *Complementary distribution in the participle prefix mi-*

a.	*mu-wallaʕ*	‘catching fire’	*mu-wassaʕ*	‘making room’
	mu-waggib	‘showing respect’	*mụ-ẉạdˤdˤạḅ*	‘preparing’
	mu-waʃwiʃ	‘whispering’	*mụ-ẉạdˤdˤạḥ*	‘clarifying’
	mu-waħħid	‘uniting’	*mu-wassax*	‘dirty’
	mu-wakkil	‘appointing’	*mụ-ẉạtˤtˤị*	‘lowering’
	mu-warri	‘showing’	*mu-wannis*	‘keeping company’
b.	*ma-habbib*	‘lousy’	*mạ-ḥạjjạsˤ*	‘enjoying himself’
	ma-ʔammin	‘securing’	*ma-ʕaggin*	‘of doughy consistency’
	ma-ʕallim	‘title of address’	*mạ-ʕ̣ạḅḅạrˤ*	‘showing consideration’
	ma-ħammad	‘Muhammad’	*ma-ħammil*	‘carrying’
	ma-ħaddid	‘defining’	*mạ-ħ̣ạṃṃạrˤ*	‘fried’
c.	*mi-ballim*	‘sullen’	*mi-tannaħ*	‘mulish’
	mi-gabbis	‘plastered’	*mi-xazzin*	‘storing’
	mi-dahwil	‘messed up’	*mị-rˤạḅḅạʕ̣*	‘square’
	mi-zannaʔ	‘crowded’	*mi-ʃammar*	‘rolled up’
	mị-dˤạḷḷịṃ	‘dark’	*mị-tˤạṇṇịʃ*	‘ignoring’
	mị-zˤạḅḅạtˤ	‘adjusted’	*mi-ɣalli*	‘raising prices’
	mi-fawwaʔ	‘awaken’	*mi-kammil*	‘completing’
	mi-lawwin	‘colored’	*mi-maddid*	‘stretched’
	mi-najjil	‘lousy’	*mị-jạṣṣạrˤ*	‘easing’

We have seen that labialization of /i/ does apply morpheme-internally (3–4). However, the change from /i/ to [a] before [ʔ, h, ħ, ʕ] is a morpheme-specific process (restricted to the prefix *mi-*). As shown in (6), morpheme-internal sequences identical to those in (5b) fail to undergo the shift.

(6) *Non-assimilating [i] before [ʔ, h, ħ, ʕ]*

mihna	‘profession’	*gihaːd*	‘struggle’
miʔdaːr	‘quantity’	*ʔiħna*	‘we’
miħna	‘hardship’	*bigiħ*	‘impudent’
fiʕlan	‘actually’	*giʕirr*	‘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 CA as discussed in the next section.

3. Features and Representations

The Parallel Structures Model (PSM; Morén 2003, 2006, 2007, *inter alia*) is a restrictive model of feature geometry in which consonants and vowels exhibit parallel structures for place, manner, and laryngeal features. The model incorporates insights from various other proposals, particularly Clements' Unified Place Model (1991), Steriade's Aperture Model (1993), Element Theory (Harris & Lindsey 1995), and Dependency Phonology (Anderson & Ewen 1987). By eliminating redundant features and building structures from less to more complex, contrastive feature combinations are maximized to ensure an unprecedented degree of economy. The identity of consonant and vowel features helps to account for numerous parallelisms and interactions in consonant and vowel behaviors. Using the PSM as a framework, we can summarize the featural specifications of all relevant segments in (7).

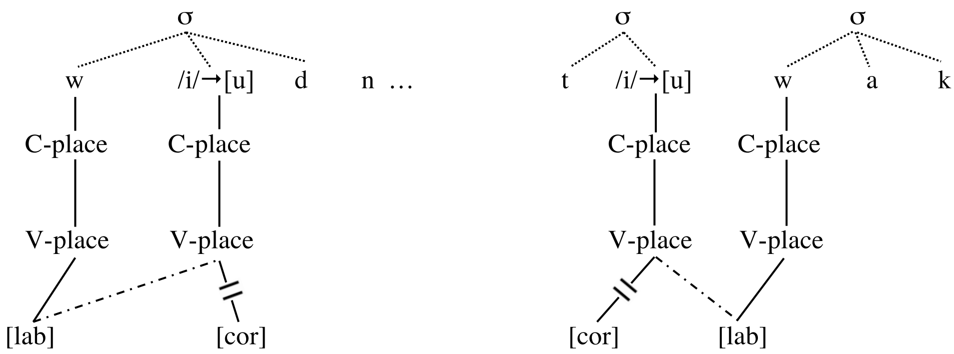
(7) *PSM feature specifications for relevant CA segments*

			V-PLACE		C-MANNER		V-MANNER	C-LARYG
	UR	SR	lab	cor	closed	open	open	voice
Conso-nants	/ʔ/	[ʔ]			✓			
	/h/	[h]				✓		
	/ħ/	[ħ]				✓	✓	
	/ʕ/	[ʕ]				✓	✓	✓
Vowels	/a/	[a]					✓	
	/i/	[i], [j]		✓				
	/ai/	[ee]		✓			✓	
	/u/	[u], [w]	✓					
	/au/	[oo]	✓				✓	

I start with cases of labialization 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]. I argue that [u] (and its glide counterpart [w]) is composed of a single V-place[lab], given that its velar coarticulation is a phonetic enhancement effect (van de Weijer 2011). The rest of this section is an analysis within autosegmental phonology (Goldsmith 1976).

(8) *Progressive & regressive labialization from [w]*

a. */widn kbi:ra/ → [wudn i kbi:ra]* b. */tiwak/ → [tuwak]*

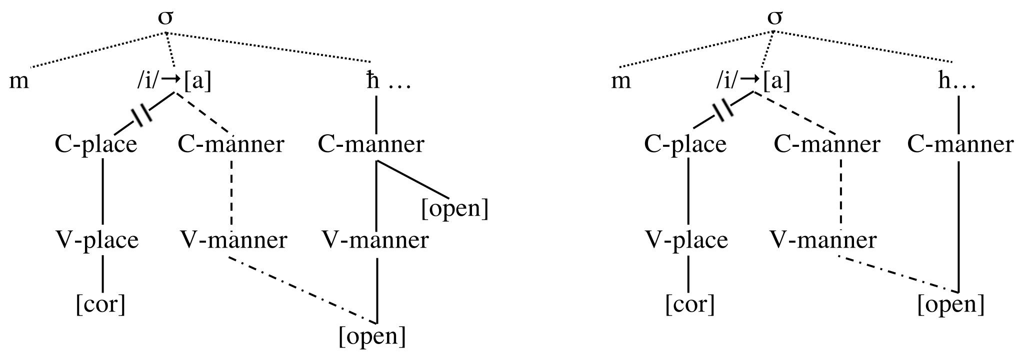


The diagrams in (8) illustrate labialization sponsored by a non-syllabic [w], targeting the preceding or following [i] nucleus. Progressive labialization is restricted to triggers in the word-initial (onset) position, which enjoys a special status within a number of phonological phenomena (Beckman 1998:52 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, as in (8a). 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 (8b). The process applies in the prosodic word domain, including within one morpheme (4) or across morpheme boundaries (5a). The failure of underlyingly bimoraic V-place[cor] vowels to labialize in the same environments (Watson 2002:265) is explained in terms of constraint interaction (§4).

The vowel [i] in the complementary distribution pattern in (5) is either underlying or supplied by a default fill-in mechanism, but it involves no spreading of V-place[cor]. The [a]-contexts are only discussed here because they interact with labialization. Triggers are the guttural (laryngeal plus pharyngeal) consonants [ʔ, h, ħ, ʕ] and, apart from [ʔ], they have fricative-like or approximant-like constriction. On the one hand, there is no contrastive evidence from CA to support a C-place[dor] specification of the pharyngeals [ħ, ʕ] (nor any other place feature). I hypothesize that [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 a front 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 (cf. 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 (9a).

(9) *[a]-contexts: V-manner[open] and C-manner[open] spreading*

a. */mi-ħammil/ → [maħammil]* b. */mi-habbib/ → [mahabbib]*



The laryngeal [h] displays similar behavior even though, being characteristically fricative, it has a single C-manner[open] feature. The spreading in (9b) 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 (cf. Clements 1991, Hume 1996) are due to a model-specific ban on vowels to have any featural content under their C-node node (which has a mere diacritic function). It follows that 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 natural class of [a]-coloring consonants, and will not be discussed 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 V-manner node.

4. Optimality-Theoretic Account

The current section provides a formal analysis of [u]- and [a]-contexts in terms of constraint interaction in Optimality Theory (OT; Prince & Smolensky 1993/2004). Let's start with progressive labialization, a process in which triggers are restricted to word-initial position. R-ALIGN V-[lab]$_{/i/}$ (10a), which ensures that a V-place[lab] feature is lined up with an /i/ nucleus vowel (see McCarthy & Prince 1993), 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 (10b), against new associations of V-place [lab] (Morén 1999), and MAX V-[cor] in (6c), 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…).

(10) a. R-ALIGN V-[lab]$_{/i/}$: In 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 (11) shows that rightward spreading of V-place[lab] is motivated by ranking R-ALIGN V-[lab]$_{/i/}$ above FAITHFULNESS. Candidate (11a) avoids ALIGNMENT violations by way of deleting the target vowel, and so it is eliminated by PHONOTACTICS. (11b) 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. (11c), turns out as optimal.

(11) *PHONOTACTICS, R-ALIGN V-[lab]$_{/i/}$ >> MAX V-[cor], DEPLINK V-[lab]*

	/uilaːda/	PHONO-TACTICS	R-ALIGN V-[lab]$_{/i/}$	MAX V-[cor]	DEPLINK V-[lab]
a.	w φ l aː d a [lab] [cor]	*!		*	
b.	w i l aː d a [lab] [cor]		*!		
☞ c.	w u l aː d a [lab] [cor]			*	*
d.	w u l uː d a [lab] [cor]			*	**!

To motivate regressive labialization, we need the shorthand alignment constraint L-ALIGN V-[lab]$_{/i/}$ in (12), 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.

(12) L-ALIGN V-[lab]$_{/i/}$: In 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 (13), candidate (13b) is rejected because it violates the high ranked L-ALIGN V-[lab]$_{/i/}$. A potential candidate that syncopates the target vowel (13a) is ruled out by PHONOTACTICS, and one that spreads V-place[lab] to the right (13d) does not win due to the extra DEPLINK V-[lab] violations. (13c) emerges as the winner.

(13) *PHONOTACTICS, L-ALIGN V-[lab] $_{/i/}$ >> MAX V-[cor], DEPLINK V-[lab]*

	/tiuak/	PHONO-TACTICS	L-ALIGN V-[lab]$_{/i/}$	MAX V-[cor]	DEPLINK V-[lab]
a.	t φ w a k [cor] [lab]	*!		*	
b.	t i w a k [cor] [lab]		*!		
☞ c.	t u w a k [cor] [lab]			*	*
d.	t u w a k [cor] [lab]			*	**!

The fact that a long vowel /iː/ fails to undergo labialization justifies the faithfulness constraint in (14a) 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 /iː/. The ranking is given in (14b).

(14) a. MAX V-[cor]$\mu\mu$: 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]$\mu\mu$ >> R-ALIGN V-[lab]$_{/i/}$, L-ALIGN V-[lab]$_{/i/}$ >> MAX V-[cor], DEPLINK V-[lab]

The ranking needed to derive a prefixal [u] is identical to (13). But to ensure a surface vowel [i] in such prefixes when no assimilation takes place, assuming Richness of the Base, we must utilize the basic feature markedness constraints *V-place[lab], *V-place[cor], and *V-manner[open]. Tableau (15) shows that ranking *V-place[cor] below the other two constraints guarantees an output prefix *mi-* regardless of the underlying vowel. The constraints L-ALIGN V-[lab]$_{/i/}$ and DEPLINK V-[lab] are not included in the tableau because they are irrelevant for this particular input.

(15) *PHONOTACTICS >> *V-place[lab], *V-manner[open] >> *V-place[cor]*

	/m{v/φ}-tannaħ/	PHONO-TACTICS	*V-place [lab]	*V-manner [open]	*V-place [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 (16a). Since this assimilation applies only to a particular /i/-final prefix, the constraint must specify the target. ALIGNMENT is in conflict with DEPLINK [open] in (16b) which penalizes new associations of C-manner[open] or V-manner[open] features. (I will simply disregard the intricacies related to non-triggers that have C-manner[open]).

(16) a. L-ALIGN [open]$_{PREF/i/}$: In 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.

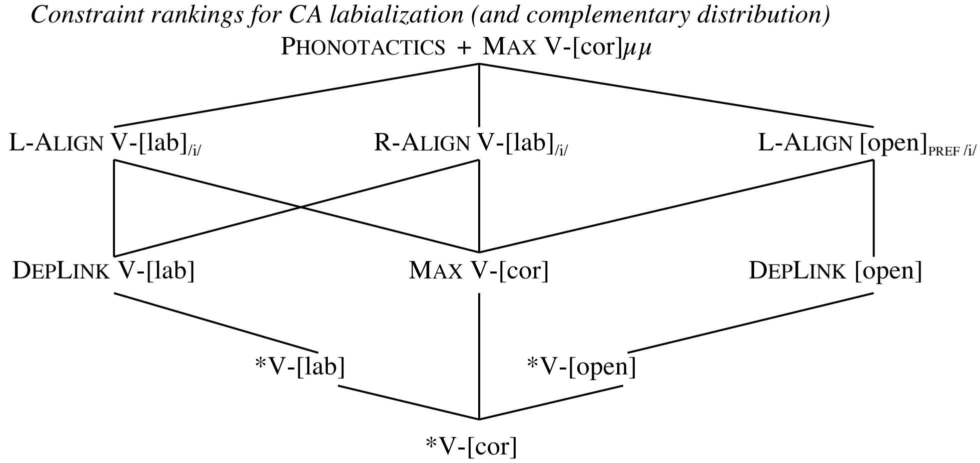
Tableau (17) shows how [a]-contexts are obtained via a similar spreading mechanism. Failure to comply with L-ALIGN $[\text{open}]_{\text{PREF /i/}}$ is fatal, and results in the elimination of (17b) and (17d). The latter candidate surfaces with [u] in the prefix, and thus incurs an extra violation of DEPLINK V-[lab]. Due to the lack of an appropriate [u]-trigger, L-ALIGN $\text{V-[lab]}_{\text{/i/}}$ is vacuously satisfied. Only output (17c) aligns the V-manner[open] feature of [ħ] to the prefixal vowel, and it emerges as optimal.

(17) *PHONOTACTICS >> L-ALIGN $[\text{open}]_{\text{PREF /i/}}$, L-ALIGN $\text{V-[lab]}_{\text{/i/}}$ >> MAX V-[cor], DEPLINK [open], DEPLINK V-[lab]*

	/mi-ħammil/	PHONOTACTICS	L-ALIGN $[\text{open}]_{\text{PREF/i/}}$	L-ALIGN $\text{V-[lab]}_{\text{/i/}}$	MAX V-[cor]	DEPLINK [open]	DEPLINK V-[lab]
a.	m φ ħ ≈ [cor] [open]	*!			*		
b.	m i ħ ≈ [cor] [open]		*!				
☞ c.	m a ħ ≈ [cor] [open]				*	*	
d.	m a ħ ≈ [cor] [lab] [open]		*!		*		*

The overall ranking can be summarized 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 (18).

(18) *Constraint rankings for CA labialization (and complementary distribution)*



5. Conclusion

This paper examined a number of morphological contexts in Cairene Arabic that exhibit complementary distribution between [i] and [u] (and sometimes [a]). I have shown that the emergence of surface [u] and [a] is largely predictable from the phonological environment. 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 a vocalic [labial] feature from an onset or coda position to a nucleus. On the other hand, the low vowel [a] is characterized by an [open] feature which it shares with the consonants [h, ħ, ʕ]. If we adopt a model of feature geometry that allows vowels and consonants to utilize the same set of place and manner features, e.g. the PSM, we can easily account for the [a]-coloring environments. These representational schemes can be incorporated in the formulation of OT constraints of various types.

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