Syllables and Moras in Arabic

Paul Kiparsky
Stanford University

1 CV-, VC-, and C- dialects

Some of the most salient differences among Arabic vernaculars have to do with syllable structure. This study focuses on the syllabification patterns of three dialect groups, *(1) VC-dialects*, *(2) C-dialects*, and *(3) CV-dialects*,[1] and argues that they differ in the licencing of SEMISYLLABLES, moras unaffiliated with syllables and adjoined to higher prosodic constituents. The analysis provides some evidence for a constraint-based version of Lexical Phonology, which treats word phonology and sentence phonology as distinct constraint systems which interact in serial fashion.

VC-dialects include the dialects of Syria, Lebanon, Palestine, Iraq, and Turkey (Behnstedt 1994, Blanc 1953, Cowell 1964, Erwin 1963, Grotzfeld 1965, Jastrow 1978, Palva 1966), Bedouin and Bedouin-type dialects such as Bani-Hassan (Jordan, Irshied & Kenstowicz 1984), the Hijazi dialects of Central Arabia (Jastrow 1980a), and the dialects of Eastern Libya (Owens 1984:12ff., Mitchell 1993:85,88), and two groups of Egyptian dialects, spoken in the Easternmost part of the Delta, and in Upper Egypt approximately to Asyuṭ (Woidich 1980:207, Behnstedt & Woidich 1985).

C-dialects are spoken over a large area in North Africa, including Morocco (Harrell 1962a, 1962b, 1965), Tunis (Marçais 1977:28, Singer 1980), and Mauretania (Cohen 1963). Like the coterritorial Berber,[2] they have long consonant sequences, which have been analyzed both as complex clusters and as sequences of syllables with consonantal nuclei. Certain Bedouin-type dialects also seem to belong in this group, as does the Maltese language.

CV-dialects constitute a distinctive group, comprising the majority of the dialects of Egypt, including Cairo, most of the Delta, the oases of the Libyan desert, and Middle Egypt (Woidich 1980, Behnstedt & Woidich 1985). They correspond to to Broselow's (1992) onset dialects.[3]

VC- and C-dialects often coexist as distinct speech registers or sociolects within a basic regional dialect. I will argue that they have the same lexical syllabification, and differ mainly in their postlexical phonology. The CV-dialects, with a distinct lexical syllabification, differ more fundamentally from both.

[1] I present a more extensive treatment of this material in my forthcoming *Paradigm Effects and Opacity*. I would like to thank Andrew Garrett, Larry Hyman, John McrCarthy, and Michael Redford for comments and discussion, and Albert Borg and Manwel Mifsud for their expert counsel on Maltese. The final version has benefited from the comments of two readers. After this paper was written I became aware that Hagstrom 1997 (who in turn refers to Potter 1994) had proposed more or less the same idea of unsyllabified moras for Mohawk and Passamaquoddy.

[2] Dell and Elmedlaoui 1985, 1988, 1996a, 1996b, 1997, Dell and Tangi 1992, 1993, Prince and Smolensky 1993, Clements 1997.

[3] But this classification does not coincide with the division between *gilit* and *q@tu* dialects (Jastrow 1978).

The table in [1] illustrates the distribution of diagnostic properties for 15 Arabic dialects, and for the Maltese language. Column G is included to show that the syllabification isoglosses do not bundle with the major word stress isogloss. The Egyptian data is from Behnstedt & Woidich (1985), that from other dialects from Fischer & Jastrow 1980, Mitchell 1993, and the additional sources indicated below.[4]

[1]

	A	B	C	D	E	F	G
	‘dog’	‘I wrote’	‘book’	‘they write’	‘they talk to’	‘her door’	‘library’
1a.	kalib	katábit	(ʔi)ktáab	yíkitbu	ikálmu	báabha	maktába
1b.	kalb	katábit	ktáab	yíkitbu	ikállmu	báabha	máktaba
1c.	kal(i)b	kitábit	(ʔi)ktáab	yikitbúun	ykalmúun	báabha	máktaba
1d.	čal@b	čatábət	ktáab	yičətbúun	yčal(l)múun	báabha	máktabi
1e.	kal(@)b	katáb@t	ktáab	yə́k(@)tbu		báabha	máktaba
1f.	kalib	kitábit	ʔiktáab	yə́k(@)tbu	ikállmu	báabha	máktiba
2a.	k@lb	ktəbt	ktaab	y@ktbu		baabha	m@ktaba
2b.	kalb	kitábt		yuktbúun	ykállmih	baabha	
2c.		ktibt	ktieb	jiktbu	jitkellmu	biebha	
		[ktipt]	[kti:p]	[jígdbu]	[jitkélmu]	[bí:ba]	
3a.	kalb	katábt	kitáab	yiktíbu	yikallímu	bábha	maktába
3b.	kalb	katábt	kitáab	yiktíbu	yikillímu	bábha	maktába
3c.	kalb	katábt	kitáab	yíkt(i)bu	y(i)káll(i)mu	bábha	máktaba
3d.	kalb	katábt	kitáab	yíktibu	yikíllimu	báabha	máktaba
3e.	kalb	katábt	kitáab	yikt^{s}ibúu	yikillimúu	bàabiháa	makt^{s}ába
3f.	kalb	katábt	kitáab	yikt^{s}ibóo	yikillimóo	bàabiháa	miktáaba
3g.	kalb	katábt	kitáab	yíktibu	yikállimu	báabha	máktaba

[4]The words in this table are meant to represent phonological types. Most cited forms are taken directly from the sources cited, but in the Egyptian data I have replaced, with fingers crossed, Behnstedt & Woidich’s type word *siláaḥ* ‘plowshare’ with the corresponding forms of *kitáab* ‘book’, which is better attested in the other sources.

[2] Key to the dialects

1. VC-dialects
   1a. Šarqiyya dialects (Easternmost part of Delta)
   1b. Upper Egypt South of Asyuṭ
   1c. Iraq (Baghdad, Erwin 1963)
   1d. Syria (Soukhne, Behnstedt 1994)
   1e. Syria (Damascus, Cowell 1964, Grotzfeld 1965)
   1f. Eastern Libya (Owens 1984)

2. C-dialects
   2a. Tunisia (Marçais 1977, Singer 1980)
   2b. Rufaidah, Southern Hijaz (Prochazka 1988:32,153,163,179,185,198,200)
   2c. Maltese (Aquilina 1959, 1987)

3. CV-dialects
   3a. Cairo
   3b. Rosetta
   3c. Damietta (Dumyāṭ)
   3d. ilBaḥariyya oasis
   3e. alFarāfira oasis
   3f. adDāxila oasis
   3g. Middle Egypt, Upper Egypt to Asyuṭ

A summary of the cross-dialectal generalizations follows.

Phrase-final -CC clusters occur unrestrictedly only in CV- and C- dialects (columns A, B). They can be broken up by an epenthetic vowel, under conditions that vary according to style and dialect. E.g. /katab-t/ *katabit, katabt* (CV-dialects), *ktəbt* (C-dialects) 'I wrote', /ʔakl/ *ʔakl*, *ʔakil* 'food', /ʔism/ *ʔism*, *ʔisim* 'name'. The VC-dialects either permit no -CC clusters (kalib, katabit) or permit them only with falling sonority (kalb, katabit).

Phrase-initial onset CC- clusters are allowed in VC- and C-dialects, which accordingly allow the pan-Arabic process that deletes high vowels in open syllables to reduce even initial CiC- to CC- (column C). The resulting clusters are often broken up by a prothetic vowel (which in turn is phonetically preceded by a glottal stop, in satisfaction of Arabic's undominated ranking of Onset). E.g. (ʔi)slaaḥ, 'plowshare', (ʔi)klaab, (ʔi)claab 'dogs', (ʔi)ḥmaar 'donkey' (silaaḥ, kilaab, ḥimaar in CV dialects).

Geminates are included in the class of permissible initial CC- clusters, a fact that will be of special significance in the analysis below. Most often arising from assimilation, initial geminates occur only in VC- and C-dialects. They can be resolved by epenthesis in the same way as other onset clusters, e.g. /l-landan/ llandan, *ʔi*llandan 'to London', /l-čaay/ č-čaay 'the tea'.

Medial -CCC- clusters are broken up as -CiCC- in VC-dialects, and as -CCiC- in CV-dialects. E.g. Iraqi *gílitla*, Cairene *ʔultí*lu(h), Moroccan q@tlu 'I/you (M.) said to him'.

"Metathesis" of medial -CCiC- to -CiCC- occurs only in VC-dialects (column D), e.g. /yi-ktib-u/ yikitbu 'they write'. CV-dialects always retain -CCiC- (yiktibu), and C-dialects

simply drop the vowel in the corresponding cases (yiktbu). Woidich 1980:212 and independently Broselow 1992:35 noticed that dialects have metathesis only if they have epenthesis of the -CCC- → -CiCC- type, and the correlation with the other VC-dialects traits can be seen for Egyptian in Behnstedt & Woidich (1985 maps 59, 66, 67). As Woidich and Broselow point out, this is evidence for interpreting metathesis as a composite process consisting of medial syncope followed by insertion of an epenthetic vowel into the resulting -CCC- cluster (-CCiC- → -CCC- → -CiCC-).

Desonorization of word-final -VCR, -VVR occurs only in CV-dialects. E.g. in N. Yemen the CV-/VC- isogloss coincides with the incidence of glottalization and devoicing (-VC̥R̥, -V̥́ʔR̥) (Behnstedt 1985:14, 48, 58). In Egypt, final glottalization occurs in a subset of CV-dialects, e.g. [kạ̥ʔl̥, mo:ʔs] (Behnstedt and Woidich 1985, maps 41-43).

High vowel deletion occurs after geminates only in the VC- and C-dialects (column E). E.g. /y-kallim-u/ (y)ikal(l)mu 'they talk to someone', /y-sakkir-u/ (y)isak(k)ru, 'they shut', /y-ʕallim-u/ (y)iʕal(l)mu 'they teach'. All CV-dialects retain the vowel, e.g. yikallimu, yiʕallimu, yisakkiru (or yikillimu etc.). In most dialects, the geminate is then shortened, but retention of a quantitative distinction between -VCC.C- and -VC.C- is attested e.g. in Qifṭ (Upper Egypt, Nishio 1994:41). For Egyptian dialects, the fact that the incidence of i-deletion after medial geminates correlates with the possibility of initial clusters and with epenthesis of the -CCC- → -CiCC- type was noted by Behnstedt & Woidich 1985:74.

Shortening of non-final CVVC- before word-level endings, and in the output of word-level syncope, occurs only in CV-dialects. E.g. /baab-ha/ babha 'her door', /saaḥib-i/ saḥb-i 'my friend', /saaḥib-a/ saḥb-a 'girlfriend' (column F).

'Cyclic' effects, such as the contrast between fhímna 'we understood' vs. fihímna 'he understood us' (Brame 1974, Kenstowicz 1981, 1996) are attested only in VC-dialects.

Opaque epenthesis/stress interactions (such as the antepenultimate stress of /fihm-na/ fíhimna 'our understanding') are attested only in VC-dialects. Only in these dialects is the epenthetic vowel invisible to lexical processes such as stress and vowel shortening. In CV-dialects, epenthetic vowels are always visible to lexical processes, and get stressed under the same conditions as regular vowels, e.g. Cairene /bint-na/ bintína 'our daughter', like maktába.

Previous theoretical literature on these phenomena has concentrated primarily on two sets of issues: the divergent ways of resolving consonant clusters by epenthesis, and the problems of cyclicity and opacity raised by the Levantine dialects. Discussion of the first question was launched by Selkirk 1981 in the context of syllable theory with a proposal that stray consonants are assigned to onsets in CV-dialects, and to rimes in VC-dialects. In a variation on this approach, Broselow 1992 argued that stray consonants are linked to syllable nodes directly in CV-dialects, and via moras in VC-dialects. A rather different approach was initiated by Itô 1986, 1989, and further developed by Farwaneh 1995. They suggested that CV-dialects syllabify left-to-right, and VC-dialects syllabify right-to-left. Mester and Padgett 1994 noted that this processual formulation can be translated into constraint-based terms by means of alignment constraints.

Research on the second complex of issues began with Brame (1974), who noted that in Levantine dialects the blocking of syncope is systematically predictable, and proposed a cyclic analysis to explain it. It was continued by Kenstowicz and others, and recently by

Kager 1999, who worked out an OT renalysis using Output/Output constraints, and also proposed a transderivational analysis for the problem of opaque stress.

In the analysis to be developed below I claim that the dialects differ in whether they license unsyllabifiable consonants by moras adjoined to the prosodic word.[5] I will refer to consonants so licensed as semisyllables. Formally, semisyllables arise where a constraint License-μ, which requires all moras to be licensed by syllables, is outranked by markedness constraints on the form of syllables and feet. The syllabic typology introduced above can be reconstructed in terms of the level at which semisyllables are licensed: (1) C-dialects allow semisyllables both at the word level and postlexically, (2) VC-dialects allow semisyllables only at the word level (License-μ is undominated postlexically), and (3) CV-dialects allow no semisyllables at any level (License-μ is undominated everywhere). I show that this analysis is superior to the directionality/alignment approach to Arabic syllabification and eliminates the O/O constraints that have been proposed for the cyclicity and opacity phenomena.

Such theoretical interest as the analysis developed here may have lies primarily in two aspects. First, it provides evidence for the violable character of Strict Layering, and in particular for moras that are unaffiliated with syllables. Secondly, it is incompatible with fully parallel OT, because it crucially requires distinct constraint systems for word phonology and sentence phonology, which moreover must interact in serial fashion. Thus, if the analysis is correct, it constitutes support for a constraint-based version of Lexical Phonology and Morphology (LPM).

The main features of the specific model of constraint-based LPM that I will assume are the following:

- Stems, words, and sentences are characterized by distinct constraint systems.
- These constraint systems are serially related.
- Morphology and phonology are cyclically interleaved in each domain.
- I/O constraints are the only type of correspondence. constraint.

I refer to this as LPM-OT. In Kiparsky (to appear) I argue that LPM-OT does a better job of explaining morphology/phonology interactions, and opaque constraint interactions, than parallel OT with an enriched correspondence theory. Trading in sympathy constraints, Output/Output constraints, and Paradigm Uniformity constraints for the intrinsic seriality of domains improves descriptive adequacy, and leads to gains in learnability, naturalness, and typological restrictiveness. Just as LPM solves OT's problems with synchronic analogy and opaque constraint interactions, so OT helps LPM complete its synchronic program of modeling the lexicon and the morphology/phonology interface and its diachronic program of providing the basis for a theory of analogical change. In the cited work I support these claims

[5]This is a preliminary hypothesis made for the sake of concreteness. The question where unsyllabifiable moras are adjoined requires more study. On general grounds one would expect them to be adjoined as low as constraints on the form of prosodic constituents allows, since that minimizes violations of strict layering. Adjunction to the prosodic word would be motivated by a constraint against the resolution of moraic trochees. A reviewer point out that adjunction to a foot entails that unsyllabified moras could never occur between two syllables that form a foot (provided adjunction is allowed only to the edges of constituents). I believe this is true for Arabic; in Mohawk and Passamaquoddy, where Hagstrom argues for adjunction to feet, precisely that structure is motivated. For more on the locus of adjunction see below.

with analyses of the principal benchmark phonological systems of the recent theoretical literature, as well as several that are new to it.

An important strand of evidence for LPM-OT is that it helps realize the typological goals of OT phonology. Crucially, an important site of cross-linguistic and dialectal variation is whether a markedness constraint is active in stems, in words, or postlexically, which determines its domain and interaction with other constraints.

It is sometimes claimed that that parallel OT is more restrictive than serial models. That is true only if correspondence theory is restricted to I/O constraints. When augmented with sympathy constraints, O/O constraints, and/or with Paradigm Uniformity constraints, parallel OT is not more restrictive than LPM. It is just different, and the differences are uniformly to its disadvantage.

While the present paper assumes LPM-OT, and its results add a measure of support to that framework, its main purpose is not to compare it with parallel OT or with rule-based serial theories. It is primarily about syllable theory and the syllable structure of Arabic vernaculars.

2 Semisyllables

Generalizing the Exhaustive Syllabification principle of Selkirk 1981, the Prosodic Licensing principle formulated by Itô 1986, 1989 requires that every segment must be assigned to a higher-level prosodic constituent. A stronger licensing requirement, Strict Layering, requires that every nonhighest prosodic or metrical element must be in its entirety a constituent of an element belonging to the next higher category on the prosodic hierarchy (Nespor and Vogel 1986:7):

[3] a. A given nonterminal unit of the prosodic hierarchy, X^p, is composed of one or more units of the immediately lower category, X^{p-1}.

b. A unit of a given level of the hierarchy is exhaustively contained in the superordinate unit of which it is a part.

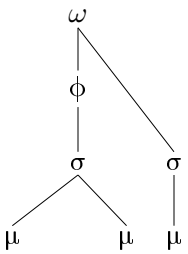
In the OT perspective, higher-ranked constraints could force violations of Prosodic Licensing and Strict Layering. "Floating" elements are presumably violations of Prosodic Licensing, occurring when it is dominated both by markedness constraints (syllable structure etc.) and by Faithfulness constraints. Such violations of Prosodic Licensing do not occur in Arabic, as far I can tell. But Strict Layering is, under certain conditions, violable in Arabic.

I assume the proposal of Selkirk 1995 that Strict Layering corresponds to a class of subconstraints which regulate the affiliation of elements in the prosodic hierarchy, and which are dominated but nevertheless visible in Arabic. Of particular interest here will be the two constraints License-μ and License-Segment, which respectively require that a mora must be affiliated with a syllable, and that a segment must be affiliated with a syllable. It is these constraints whose ranking determines the syllabic typology of Arabic vernaculars.

The claim that Strict Layering constraints are violable has respectable roots even in pre-OT work. Aside from extrametrical and floating elements, which violate Prosodic Licensing

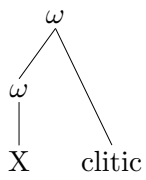
and a fortiori Strict Layering, several other types of prosodic representations which violate the latter constraint have been motivated by Itô and Mester 1992 under the heading of weak layering. For metrical constituency, Itô and Mester propose structures of the form [4].

[4]

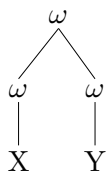


Structures of the form [5], required for cliticization and compounding, respectively, also violate Strict Layering.[6]

[5] a.



b.



Itô and Mester claim that Strict Layering does hold between moras and syllables, and formulate a principle ("Mora Confinement") which states that μ can only be licensed by σ. This would be an unexpected restriction on their otherwise general hypothesis. I shall argue that the Weak Layering hypothesis holds in complete generality.

Violations of Weak Layering for moras require no novel constraints. The possibility is already inherent in the uncontroversial constraints of standard syllable theory. Suppose that Foot-Binarity, License-Seg (which requires that a segment be licensed by a syllable or mora) and the relevant Max and Dep constraints all dominate the requirement that a mora must be affiliated with a syllable (License-μ). OT principles require, other things being equal, the representation which constitutes the minimal violation of the constraints. To avoid gratuitously violating Prosodic Licensing, a mora that cannot be affiliated with a syllable should be affiliated with the lowest possible superordinate prosodic category. In Arabic, affiliation of an unsyllabified mora with the next higher category foot would violate the otherwise undominated constraints on foot size. I will therefore assume that it is affiliated with the prosodic word, which is not subject to any size constraints (or at least not to any size constraints that would bar this affiliation).

Previous evidence for moraic licensing includes Hyman 1985 for Gokana, Zec 1988 for Bulgarian, and Buckley 1994, 6.4 for Kashaya. Moras that are prosodically licensed by adjunction to a superordinate prosodic category offer a way to accommodate what an older phonetic tradition originating with Sievers has called semisyllables, or minor syllables, (Sievers' Nebensilben). I shall adopt the term semisyllable here to denote such an unsyllabified

[6] See Han 1994 for compelling arguments that these are in fact the correct representations, and additional evidence in favor of the Itô-Mester theory of weak layering.

mora, without meaning to imply that all the things that have been called semisyllables are necessarily to be analyzed that way.

Semisyllables offer what is arguably the right representation for trimoraic trochees, including superheavy syllables and resolved trochees. Bye 1997 argues that Estonian and Saami superheavy (overlong, Q3) syllables have a third unsyllabified mora after the bimoraic core. He actually suggests that the unsyllabified mora in such sesquisyllabic structures is freestanding, but that does not seem to be an essential feature of his analysis.

In a number of Slavic languages, nonsyllabic sonorants occur ar word edges in positions where they violate the sonority sequencing constraint. For example, Russian words like [6a] are monosyllabic (as evidence from stress, versification, etc. shows). In Czech, word-initial liquids are nonsyllabic, while consonant+liquid sequences are syllabic (Rubach & Booij 1990).

[6] a. Russian: *mglá* 'mist', *rtá* 'mouth' (gen.) (one syllable)

b. Czech: *rty* 'lips', *rvát* 'pull' (one syllable), *srdce* 'heart', *zrno* 'corn', *vlna* 'wool', *vichr* 'wind', *bobr* 'beaver', *bratr* 'brother' (two syllables)

In some Mon-Khmer languages, the canonical word structure is a sesquisyllable (a "$1\frac{1}{2}$-syllable"), carefully documented for Kammu by Svantesson 1983. Svantesson proposes that sesquisyllables are regular syllables with a prepended headless syllable (syllable with an empty nucleus, a minor syllable, in his terminology).[7] A degenerate syllable treatment has been worked out by Shaw 1993 for Bella Coola semisyllables; Cho and King 1996, and this volume, also argue that some semisyllables are nonmoraic syllables.

A more minimalist view of semisyllables, in line with the proposal of this paper, is that they are unsyllabified moras. Sesquisyllabic structures, then, would be regular syllables with a prepended mora. Bagemihl 1991 suggests this analysis for Bella Coola, where semisyllables are not constrained by position or sonority.

I do not wish to claim that headless syllables are ruled out in principle; in fact, it is possible that they occur, in addition to both unsyllabified moras, in Kammu. Svantesson distinguishes between non-tonal and tonal semisyllables. Non-tonal minor syllables contain just a single consonant, with the possibility of an added schwa in careful speech, e.g. c.mɔɔl 'to sow'. Tonal minor syllables are of the form CC-, where the second consonant is either a sonorant (e.g. hr.maal 'soul') or a reduplicated copy of the stem-final segment, which may be an obstruent (e.g. rt.yuut 'bellows'). The former would be a semisyllable in my terms, the latter a degenerate (headless) full syllable.

One virtue of the interpretation of semisyllables as unsyllabified moras offered here is that it implies that they are not necessarily restricted to consonants. If Onset is also added to the set of constraints that dominate License-μ, then onsetless syllables will be avoided by treating onsetless vowels as semisyllables. Several researchers have indeed noticed that onsetless initial vowels tend to have a special prosodically defective status in various languages, of a kind that suggests that they are not syllables in their own right at least at some level of representation. Mutaka and Hyman 1990, in their study of Kinande reduplication, argue that there are only CV syllables at the stem level, and that unsyllabified moras join syllables at a later stratum (or postlexically). Downing 1998 pursues this analysis and relates it

[7] Taking a maximalist position, van der Hulst and Ritter 1998 argue that sesquisyllables consist of two feet, each containing two degenerate syllables.

to the Onset constraint of Prince & Smolensky 1993. Further evidence for the degenerate status of onsetless syllables has been presented by McCarthy and Prince 1993 and Odden 1995. In terms of the constraints assumed here, a parse as unsyllabified moras follows straightforwardly from the constraint ranking in which Onset, Max, and Dep dominate License-μ.

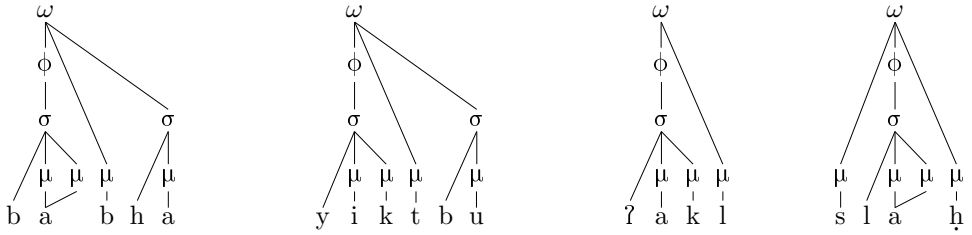
The basic argument for treating semisyllables as unsyllabified moras is that it immediately explains their characteristic cross-linguistic properties:

[7] a. Unstressed, toneless, or reduced tonal contrasts
b. Restricted segmental inventory
c. Can be less sonorous than syllable nuclei
d. Restricted shape (e.g. no onset, or no branching onset, no coda)
e. Sometimes restricted to peripheral position (typically word edges)
f. Prosodically invisible
g. Can be subject to minimum sonority requirement

Precisely these properties hold for the second (nonhead) mora of syllabic nuclei. On the assumption that they are properties of non-head moras, the present proposal predicts them for semisyllables as well.

In the C- and VC- dialects, License-μ is ranked below the constraints that impose syllable and foot well-formedness, and below Reduce (Kirchner 1996, McCarthy 1999), which requires minimizing the duration of light syllables on the scale a > i,u > ∅ (in practice, in non-final position, because a dominant Alignment constraint preserves vowels at the right edge). This ranking will result in certain sesquisyllabic structures. For example, on /baab-ha/, /yi-ktib-u/, /ʔakl/, and /silaaḥ/, it imposes the syllabification [8] in the C-dialects, and, at the word level, in the VC-dialects as well:[8]

[8] Semisyllables in VC- and C-dialects:

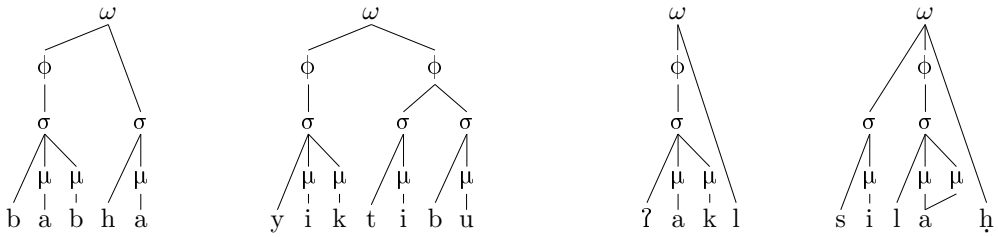


Postlexically, VC-dialects epenthesize a vowel before moraic consonants under certain (partly variable) conditions, e.g. (yík)t_μ.bu → (yi.ki)t_μ.bu, (ʔak)l_μ→ (ʔa.ki)l_μ, and, optionally, in initial clusters that result from deletion, e.g. s_μ.(laa)$\underline{h}_\mu$→ (ʔís).(laa)$\underline{h}_\mu$.

The CV-dialects, where avoidance of semisyllables is a high-priority constraint, the syllabification in [9] results instead, and is retained in the postlexical phonology:

[8] For the moment, let us assume that the foot structure of all dialects of Arabic is organized into moraic trochees.

[9] In CV-dialects, moras must be affiliated with syllables:



Crucially, moras which are not affiliated with syllables or feet do not count towards syllable weight or foot size. Therefore, all dialects that allow semisyllables permit what look like superheavy syllables, that is, on our analysis regular syllables with an adjoined semisyllable.

Additional evidence that unsyllabified and unfooted moras do not count for prosodic minimality is furnished by the relationship of epenthesis and lengthening in the dialect of Dēr izZōr spoken in Syria (Jastrow 1978:79-80, 87).[9] Like most dialects of Arabic, Dēr izZōr categorically prohibits monosyllabic lexical words of the form (C)CV̆C. Such words would have only a single mora because an undominated constraint Final-C forces final consonants to be weightless. When the morphology forms such words, they are accommodated to the minimum word requirement in one of two ways. Either the root vowel is lengthened (see [10a]), or alternatively, a prothetic stressed i (or u, in back contexts) may be added, in which case the root vowel remains short (see [10b]). As in other dialects of this type, all initial clusters may optionally get a prothetic vowel. Because epenthesis is postlexical, the prothetic vowel is unstressable, hence does not count towards satisfaction of the word minimum. Therefore, lengthening takes place regardless of prothesis (see [10c]).

[10] a. /kal/ kōl ‘eat’, /ktib/ ktēb ‘write’, /rkab/ rkāb ‘climb’, /ḍrab/ ḍrāb ‘hit’ (2Sg.Masc. imperatives)

b. ɪ́ktib ‘write’, ɪ́rkab ‘climb’, úḍrub ‘hit’

c. škūn ∼ iškún̄ (*iškún) “what”

Thus, /ktib/ ‘write!’ has three possible pronunciations in the Dēr izZōr dialect: ktēb, iktḗb (lexical lengthening with optional postlexical epenthesis), and ɪ́ktib (lexical epenthesis). Impossible, on the other hand, are the following pronunciations: *ktib (too short), *iktɪ́b (with postlexical epenthesis the word still does not satisfy the lexical word minimum, with lexical epenthesis the stress is misplaced), *ɪ́ktēb (if postlexical epenthesis, it has the wrong stress, if lexical epenthesis, the vowel lengthening is unnecessary, constituting a gratuitous Dep violation).

Jastrow 1978 insightfully explains these and other data on the basis of a distinction between phonemic and phonetic epenthesis, which in this case is for practical purposes equivalent to our distinction between lexical and postlexical epenthesis. A similar idea figures in other traditional and structural grammars of Arabic as well.

[9] See Behnstedt 1994:64 for traces of a similar system in the Syrian dialect of Soukhne.

3 Overview of the analysis

The syllable structure of the dialects differs in the ranking of License-μ in the word-level phonology. In the VC- and C-dialects, it is outranked by a number of faithfulness constraints (of both the Max and Dep type), by the markedness constraints Foot-Bin, License-C, and by Reduce (which minimizes the number of light syllables, specifically, because of dominating Align and Max constraints, of nonfinal light syllables with high vowels); in CV-dialexts, it dominates them. [11] and [12] show the basic idea in schematic form.

[11]

VC-dialects: Word level	Reduce	Max-μ	License-μ	...
Input: [(baa)b]-ha				
1a. ☞ (báa)b_μ.ha	**		*	
1b. (bab).ha	**	*		
1c. (báa).(bi.ha)	***			
Input: [ki.(táa)b]				
2a. ☞ k_μ(táa)b			*	
2b. ki(táa)b	*			
Input: [(yík).(ti.bu)]				
3a. ☞ (yík).t_μ.bu	*		*	
3b. (yík).(ti.bu)	**			

[12]

CV-dialects: Word level	License-μ	Reduce	Max-μ	...
Input: [(baa)b]-ha				
1a. (báa)b_μ.ha	*	**		
1b. ☞ (bab).ha		**	*	
1c. (báa).(bi.ha)		***		
Input: [ki.(táa)b]				
2a. k_μ(táa)b	*			
2b. ☞ ki(táa)b		*		
Input: [(yík).tib]u				
3a. (yík).t_μ.bu	*	*		
3b. ☞ (yík).(ti.bu)		**		

Because of the low ranking of License-μ in VC- and C-dialects, they preserve the long vowel in /baabha/, and delete the syllable-final -i- in /fihimna/ and /yiktibu/, in each case forming an unsyllabified moraic consonant. In the VC-dialects, however, License-μ is promoted in the postlexical phonology, causing epenthesis of an unmarked vowel (i, or @, in those dialects that have it) before semisyllables.[10] In the VC-dialects, the vowel is epenthesized before rather than after the semisyllable because of prosodic Faithfulness: it is the minimal modification

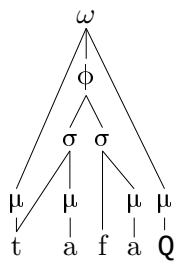
[10]The quality of the epenthetic vowel varies but generally in a uniform way for medial, initial, and final syllables in a given dialect. The vowel is most often *i* (in Syrian @ sometimes *ɨ* or *e*), and under dialectally varying conditions it are liable to be assimilated to a back vowel in the preceding syllable, e.g. *mnúqutlu* 'we'll kill him', *rukub* 'riding', *šahar* 'month' (Palestinian, Palva 1966:30, 53). Epenthetic vowels are "often pronounced as full vowels and as such are phonetically comparable with phonemic vowels occurring in the same positions." (Palva 1966:42 ff.).

that brings the word-level moraic (semisyllabic) parse into line with the language's surface syllable canon. Thus, (yík).t_μ.bu → (yí.ki)t_μ.bu, not (*yík).(ti.bu).

Non-final CVVC syllables that arise in the word-level phonology surface in all VC- and C-dialects, because these dialects license the third mora -C as a semisyllable ((báa).b_μ.ha 'her door'). In the CV-dialects, License-μ ranks high at the word level, forcing violations of faithfulness constraints and phonological constraints, depending on their ranking. Most CV-dialects eliminate CVVC- syllables by shortening the vowel, e.g. /baab-ha/ → bábha. Some do it by epenthesis (baabiha), and some Middle Egyptian dialects accommodate superheavy syllables as is (baabha). These three subtypes of CV dialects arise by variation in ranking between the constraints Dep-μ, Foot-Bin, and Max-μ.

Phrase-initial onset CC- clusters are allowed only in VC- and C-dialects, e.g. s_μ(laa)$ḥ_\mu$ ∼ (ʔís).(laa)$ḥ_\mu$, 'plowshare, weapon', vs. si.(laa)$ḥ_\mu$ in CV-dialects. Syncope is allowed to create initial clusters only where their first consonant can be licensed as a semisyllable. The distribution of initial geminates is similar, e.g. Syrian (Mitchell 1993:92 ff.) /n-midd/ mmidd 'we extend', /w-t-afaQ/ ttáfaQ 'he agreed' (infixed /t/), Moroccan /ttə-ktəb/ ttəktəb 'it was written'. The semisyllabic analysis of initial geminates is shown in [13].

[13]



In addition to the dialectal distribution of geminates, this representation accounts for their phonological properties. They are bimoraic, hence true geminates, as shown by the fact that they commonly arise by assimilation. While the first member is moraic, it is nonsyllabic, hence invisible to stress, and does not satisfy word minimality constraints. Because final consonants and the initial consonant of a geminate are both semisyllables, a hypothetical *mmut would have a monomoraic foot; therefore it is not a possible word.

Medial -CCC- clusters can be parsed in VC- and C-dialects by making the middle consonant a semisyllable, e.g. /gil-t-la/ → (word level) (gil).t_μ.la → (postlexical) (gi.li)t_μ.la in VC-dialects, but /ʔul-t-lu/ → (ʔúl)(ti.lu) in CV-dialects.

"Metathesis" is restricted to VC-dialects. I follow a long tradition of Arabic phonology in treating "metathesis" as syncope followed by epenthesis (Mitchell 1960, Woidich 1974, Woidich 1980:211, Kenstowicz and Abdul-Karim 1980, Kenstowicz 1986, Broselow 1992). Syncope is driven by Reduce at the word level (/yiktibu/ → (yik)t_μ.bu) and epenthesis is postlexical as before ((yik)t_μ.bu → (yi.ki)t_μ.bu).[11] In CV-dialects, word-level syncope is blocked after clusters, because they do not allow the semisyllable needed to parse its output in conformity with Foot-Bin, hence /yi-ktib-u/ → (yik).(ti.bu). C-dialects simply have deletion without postlexical epenthesis. My analysis requires, and is in a sense a consequence of, the

[11]Not all VC-dialects undergo "metathesis". Dialects which otherwise have VC-phonology but retain the medial -CV- in cases like *yiktibu* are found in Mesopotamia and Anatolia, e.g. Mardin *yQktQbūn* 'they write' (Jastrow 1978:204), and the Gulf, e.g. Makkan *yiktub, tiktubu* (Jastrow 1980a).

intrinsic serialism of levels in LPM. Any evidence for it will thus further support LPM-OT over parallel OT. The analysis of "metathesis" thus crucially depends on the serial relation between the word-level and postlexical phonology. The two constraint systems induce an intrinsic ordering /yiktibu/ → yík.t$_\mu$.bu → (yí.ki)t$_\mu$.bu. This is also the key to our solution to the opacity and cyclicity problems.

High vowels delete after geminate consonants only in VC- and C-dialects: /y-kallim-u/ y(i)kal(l)mu 'they talk to someone', vs. yikallimu in CV-dialects. Only in the former can the resulting superheavy syllable be prosodically licensed.[12]

The correlation of medial syncope, "metathesis", and retention of superheavy syllables follows because deletion of light vowels and retention of superheavy syllables are prosodically licensed the same way; in VC-dialects they can apply more widely because semisyllables are allowed. Several intermediate forms VC- and CV-dialects are also attested, corresponding to the possibility of ranking License-μ at several points among the other constraints.

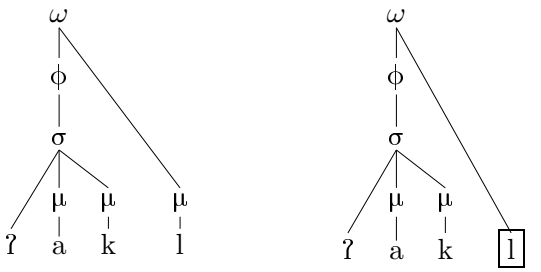
Phrase-final -CC clusters that violate sonority sequencing occur only in CV- and C-dialects, but their status is quite different in the two types. In VC- and C-dialects, the second C is licensed as a semisyllable at the word level, and in VC-dialects an epenthetic vowel is inserted before it, at least if the cluster violates sonority sequencing. E.g. the lexical representation of /akl/ is ʔak.l$_\mu$ in VC-dialects and in C-dialects; the semisyllable is broken up by postlexical epenthesis in VC-dialects (ʔakil). In CV-dialects, on the other hand, the second consonant is parsed in the word phonology as a non-moraic stray consonant (an "extrametrical" consonant adjoined to the prosodic word), viz. ʔakl; therefore epenthesis is inapplicable.

Desonorization of word-final consonants seems to be a trait of CV-dialects. It characteristically involves devoicing and glottalization, sometimes near-deletion. In Northern Yemen, the Western dialects break up final -CC clusters of rising sonority with an epenthetic vowel, a VC-dialect trait, e.g. /ʔism/ → (ʔi)sim 'name', /ʔibn/ → (ʔi)bin 'son'. Those of the Eastern part seem to be of the CV-type, and lack epenthesis in -CC clusters. In these dialects, final consonants, including sonorants, are glottalized after a long vowel and devoiced in clusters: V̄ʔC̥, -VCC̥. Jastrow 1980a:110 reports similar desonorization phenomena for Southern Yemen, which also retain -CC. Epenthesis and desonorization thus seem to be in complementary distribution (Behnstedt 1985:14, 48, 58). In some Egyptian dialects, again of the CV-type, word-final consonants are devoiced and an intrusive glottal is heard, e.g. /-al/ → [ḁʔl̥], /-ooz/ → [ōʔs], Behnstedt & Woidich 1985, maps 41-43).[13] This distribution can be understood if we take desonorization to be a process that applies to non-moraic consonants, in terms of the syllable structure of VC- and CV-dialects proposed in [8] and [9]. Thus the boxed consonant in [14b] undergoes desonorization:

[12]The geminate is postlexically shortened in many, perhaps the majority of dialects, often optionally (Mitchell 1993:95-96); for some reason no CV-dialect has lexical degemination, which would allow deletion after geminates.

[13]Turkish-style final devoicing, without glottalization, is naturally widespread in Anatolian and other Northern dialects of Arabic, including those of the CV-type (Jastrow 1978). Nigerian Arabic glottalizes all prepausal segments including vowels (Owens 1993:21-22). Sudanese Arabic also has final glottalization, perhaps a substrate effect (Michael Redford, 1996 *et voce*).

[14]



(a) VC-dialects (b) CV-dialects

That moraic consonants should tend to remain more sonorous than nonmoraic consonants makes good phonological sense, since moraic elements are known to be subject to sonority restrictions (Zec 1988).

Cyclic blocking of syncope, typified by the fihímna : fhímna contrast, is restricted to a group of VC-dialects. All Levantine dialects are said to have it (Mitchell 1993:156). To my knowledge it has not been reported for any CV-dialect, and this is predicted, for in CV-dialects, deletion cannot give rise to forms like fhím-na 'we understood' in the first place, so the question of blocking that deletion by lexically assigned stress does not arise. In C-dialects, Reduce outranks Max-V́, so that stem-level stresses do not protect vowels from deleting at the word level; thus these cyclic effects cannot surface. The next tableau shows the word level phonology of VC-dialects; the corresponding tableau for CV-dialects follows.

[15]

VC-dialects	…	*Complex	Max-[V́]	Reduce	License-μ	…
1. Input: [(fí.hi)m$_\mu$] 'he understood' (unsuffixed): no change						
2. Input: [fi.(hím$_\mu$)na] 'we understood' (stem level suffix)						
2a. fi.(hím).na				***		
2b. ☞ f$_\mu$(hím).na				**	*	
2c. (fhím).na		*		**		
3. Input: [(fí.hi)m]-na 'he understood us' (word level suffix)						
3a. ☞ fi.(hím).na				***		
3b. f$_\mu$(hím).na			*	**	*	
3c. (fhím).na		*	*	**		

[16]

CV-dialects	…	*Complex	Max-[V́]	License-μ	Reduce	…
1. Input: [(fí.hi)m] 'he understood' (unsuffixed): no change						
2. Input: [fi.(hím)na] 'we understood' (stem level suffix)						
2a. ☞ fi.(hím).na					***	
2b. f$_\mu$(hím).na				*	**	
2c. (fhím).na		*			**	
3. Input: [(fí.hi)m]-na 'he understood us' (word level suffix)						
3a. ☞ fi.(hím).na)					***	
3b. f$_\mu$(hím).na			*	*	**	
3c. (fhím).na		*	*		**	

Invisibility of epenthetic vowels to lexical constraints (such as stress and shortening) is restricted to VC- and C-dialects, because in these dialects stray consonants are licensed as

semisyllables, so epenthetic vowels are not present at the word level.[14] This results in surface violations of the otherwise inviolable requirement that the last non-final foot is stressed, e.g. /fihm-na/ → (word-level) (fíh)m_μ.na → (postlex.) fíhim-na 'our understanding'. On the other hand, stray consonants cannot be licensed in CV-dialects (except word-finally), so they must receive an epenthetic vowels in the lexical phonology, which is necessarily visible to stress like any other lexical vowel. E.g. Cairene (ʔul)(tí.lu) 'I/you (masc.sg.) said to him' is stressed like (mak)(tába).

In sum, apparent surface exceptions to stress arise when the conditions for lexical stress assignment are masked by postlexical epenthesis. A word like fíhim-na is disyllabic for purposes of the word phonology, including stress. The assumption that unsyllabifiable consonants are semisyllables in the lexical phonology of VC-dialects explains the opaque constraint interaction of stress and epenthesis.

The licensing of semisyllables in VC-dialects is subject to certain constraints. In order to derive ka(táb)t_μ rather than *(káta)$b_\mu t_\mu$, and to exclude hypothetical forms with complex consonant clusters, we must assume that some constraint prohibits two adjacent semisyllables.[15] This has a further consequence: the two middle consonants of a medial four-consonant cluster cannot be licensed as consecutive semisyllables. Epenthesis is then lexical, making the closed syllable visible to stress. In an input such as /kitab-t-l-ha/, -tl- cannot be parsed as two semisyllables, nor (since semisyllables are onsetless) as one. The cluster must therefore get a full syllable for all its consonants to be parsed. A full syllable requires a vocalic nucleus, therefore gets an epenthetic vowel, forming a closed syllable at the word level. Contrast:

[17] a. /kitab-l-ha/ → (w.l.) *ki.táb.l_μ.ha* → (postlex.) ***kitábilha*** 'he wrote to her'
b. /kitab-t-l-ha/ → (w.l.) ***kitabtílha*** 'I wrote to her'

In the following sections I motivate in more detail some aspects of the analysis just sketched out.

4 Initial geminates

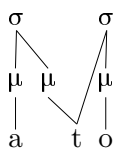
Mitchell's phonetic description of initial geminates in Arabic states clearly that they share with medial geminates the phonetic characteristics of length and tenseness: "All types of gemination reveal not only an increase of duration over non-gemination but also greater muscular tension and pulmonary pressure, a more extensive spread of tongue-palate contact, increased loudness of adjoining vowels and 'incisiveness' of on- and off-glides (especially in the case of plosive consonants), as relevant phonetic characteristics." (1993:92). "An epenthetic vowel may be heard initially in most cases of initial gemination but it is never essential and is better omitted in the [Moroccan, Iraqi, and Levantine] vernaculars..." (ibid.) Owens

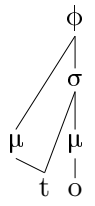
[14] Nevertheless, there are some VC-dialects in which epenthesis is lexical under some conditions, particularly in the case of clusters which violate sonority sequencing. In these dialects, a constraint requiring sonority peaks to be syllable heads has been promoted in the lexical phonology.

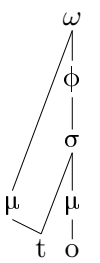
[15] A reviewer suggests that a parallel to this constraint can be found at the level of syllables. There are languages that permit single unfooted syllables, but force two adjacent unfooted syllables to form a foot. Similarly, in Arabic, two adjacent unsyllabified moras must form a syllable, forcing epenthesis of a nucleus.

(1984:26) similarly states that gemination in Eastern Libyan "may have a realization as glottalization or an increased length on an initial consonant, the latter realization common before voiceless consonants and nasals".

Initial geminates constitute fairly direct evidence for unsyllabified moras. Given that that assimilation is the spread of a melody over timing slots or syllabic positions, an assimilated geminate must be affiliated with two such positions. In a medial geminate, these positions are the coda of one syllable and the onset of the next, or, in the most popular version of the moraic theory, the second mora of one syllable, and the syllable node of the next. Onset geminates must have some extra syllabic position, and under standard assumptions, this can only be a mora. (It cannot constitute a syllable of its own, since the geminate consonant does not function as a syllable peak.) This mora must be affiliated with the foot or the word, presumably depending on whether it adds weight. Thus moraic theory requires representations like [18a] for medial geminates, as in a hypothetical word atto, and [18b] or [18c] for initial geminates, as in tto.

[18] a. 

b. 

c. 

If we adopt this representation of initial geminates for Arabic we can immediately explain why their distribution correlates with the distribution of initial clusters. In Arabic, initial geminates are restricted to C-dialects and to those VC-dialects that allow initial clusters. In CV-dialects, initial clusters are categorically excluded.

[19] a. CV-dialects: Egyptian kitaab 'book' (*ktaab), siláaḥ 'plowshare', katábt 'I wrote', fihímt 'I understood'

b. VC-dialects: Levantine ktaab ∼ ʔktaab 'book', sláaḥ ∼ ʔsláaḥ 'plowshare', *claab* ∼ ʔclaab 'dogs' (Iraqi, Erwin 1963:), kt@bt 'I wrote' (Syrian, Grotzfeld 1980:177), fhímt 'I understood'.

c. C-dialects: ktəbt 'I wrote', fžəmb ṭṭreeq 'at the side of the road', lḥəm žžməl 'camel meat', flQšiya 'in the evening' (Moroccan, Mitchell 1993:62-65), ktibt 'I wrote', klāb 'dogs' (Tunis) nḥrag 'he was burned' (Mzāb), ktabt 'I wrote' (Benghazi) (Singer 1980:257, 255, 260).

Many initial geminates arise by assimilation of consonantal prefixes or infixes to stem-initial consonants ([20a-g]). In Maghrebi dialects, initial [tt-] seems to mark passive verbs ([20h-i]) and stative verbs ([20j]).

[20]	a.	/b-baal-a/	bbáala	‘in his mind’ (Iraqi)
	b.	/l-landan/	llandan	‘to London’ (Iraqi)
	c.	/w-walad-ha/	wwaládha	‘and her son’ (Iraqi)
	d.	/b-fuut/	ffuut	‘I go in’ (Syrian)
	e.	/l-rjaal/	rrjaal	‘the men’ (Syrian)
	f.	/l-šriik/	ššriik	‘the partner’ (Syrian)
	g.	/w-t-afaQ/	ttáfaQ	‘he agreed’ (infixed /t/) (Syrian)
	h.	/ttə-ḍṛəb/	ttəḍṛəb	‘it was beaten’ (Moroccan)
	i.	/tt-ṣab/	ttṣab	‘it was found’ (Moroccan)
	j.	/t-ṭeellәb/	ṭṭeellәb	‘to be a mediocre student’ (Algerian, Singer 1980:264-5)

CV-dialects admit no initial consonant clusters, hence in particular no initial geminates, so prothetic [ʔi-] is obligatory in cases comparable to [20]. Similarly, those VC-dialects that avoid word-initial clusters tend to have obligatory prothesis before initial geminates, e.g. Cyrenaican Bedouin.

Therefore, I take the parallelism between initial geminates and consonant clusters as support for the semisyllable analysis.

Could the parallelism be accounted for without invoking mora theory? Owens' (1980) structural analysis of Eastern Libyan is one analysis which attempts to do that. He takes the first member of an initial geminate as the realization of a vowel “v”, which is the epenthetic vowel here written i. [21a] is his representation of an initial geminate, and [21b] shows a variant articulation where the first member is replaced by a glottal:

[21]	a.	j j lu:d ‘skins’	b. ʔ t tikállam ‘you m. speak’
		| | |	| | |
		vCC	v CC

To update something like Owens' analysis, we would have to reintroduce CV slots or X-slots into phonological representations (Clements and Keyser 1983, Levin 1985), and that is just what Hume, Muller, and van Engelenhoven 1997 advocate. With one crucial exception, their data on Leti gemination is very similar to the Arabic data discussed here, but they arrive at a different conclusion. In both languages, geminates pattern distributionally with consonant clusters (in Leti, geminates and clusters occur underlyingly only in word-initial position). They arise in medial as well as initial position by assimilation of adjacent consonants, and unlike other two-consonant sequences, may not be broken up by epenthesis (for Arabic, see Abu-Salim 1980) — evidence that they have a single root node. And in both languages, initial geminates do not count towards the weight of the syllable that follows.

Hume, Muller, and van Engelenhoven nevertheless reject representations such as [18b,c]. The reason has to do with an optional postlexical process which “downgrades” the prosodic prominence of the first of two syntactically related words, with certain concomitant vowel reduction processes. Words with long vowels and words with geminates, including inital geminates, cannot undergo this Downgrading process. Hume, Muller, and van Engelenhoven capture this restriction with a Length-to-Prominence constraint which requires a long segment to be in a prominant domain, and plausibly suggest that its functional motivation is to prevent the merger of durational contrasts. They then state that this constraint is inconsistent with the moraic (‘semisyllabic’) representation of geminates: “Since a mora unattached

to a syllable node would not contribute to syllable weight, a geminate-initial syllable would again not be predicted to pattern with long vowels in terms of weight. Note that this same problem would arise if the extrasyllabic mora were linked to a node higher than the syllable, e.g. foot, phonological phrase."

Actually, there is no difficulty with the moraic representation if we distinguish carefully between segment length and syllable weight. Let us say that a segment is long if it is affiliated with more than one timing slot (mora or syllable). And let us say that a syllable is heavy if it has more than one mora (and, of course, superheavy if it has more than two moras). Then the initial consonant in [18b] is long (bimoraic), but the first mora that it is affiliated with does not contribute to syllable weight, because it is not part of the syllable. The Length-to-Prominence constraint can then be stated in terms of segment length, exactly as Hume, Muller, and van Engelenhoven have it, and it will correctly refer to long vowels and geminates, including initial geminates.

A second objection that Hume, Muller, and van Engelenhoven raise to the moraic representation [18b] is that it violates Prosodic Licensing. But this is the case only if the unsyllabified mora is stray. Since the unsyllabified mora can be affiliated with a higher prosodic category, as they recognize in the passage quoted above, this objection does not seem valid either.

My proposal immediately entails that there could exist languages in which initial geminates are not only long but weight-bearing as well. These would be languages in which a stray mora is associated at the syllable level, or perhaps at the foot level. Hart 1991 shows that Trukese is a case of just this type (see also Davis 1998). Like Arabic, Trukese has a bimoraic word minimum and an undominated constraint that requires final consonants to be weightless. Because final consonants do not contribute to syllable weight, words like maa 'behavior', tiip 'emotions' are possible, wheras words like *ba, *ban do not occur. Yet words with initial geminates allow both of these otherwise forbidden rhyme types, e.g. tto 'clam sp.', ffen 'advice'. The conclusion is that in Trukese, initial geminates contribute to prosodic weight, and that the weight-bearing mora must be contained within the prosodic category in terms of which the minimality constraint is stated. Supposing this to be the foot, the structure of tto in Trukese would be as was shown in [18b].

A second, similar case would be Piro (Lin 1997). Lin works out a moraic licensing analysis of stray consonants, including initial geminates. Since Piro has compensatory lengthening effects, the semisyllables would be have to be associated at the foot level, according to what I said above. This appears to be compatible with Lin's analysis, though Lin opts for the alternative affiliation at the prosodic word level.[16]

5 Sonority, syllabicity, epenthesis

Nearly all CV- and C-dialects allow phrase-final -CC clusters.[17]

[16]Interestingly, Lin's analysis depends on cyclic constraint evaluation. However, Lin assumes that all segments are redundantly moraic in underlying representations, which seems incompatible with Richness of the Base.

[17]Final -CR clusters of rising sonority are avoided under some conditions, even if they are not categorically excluded (Cohen 1975:80).

[22] a. CV-dialects: katábt 'I wrote', *ʔ*akl 'food', *gabr* 'algebra' (phrase-finally), but *ʔ*akli maṣri 'Egyptian food'.

b. C-dialects: ktəbt 'I wrote', Moroccan ṣṭḥăqt 'I needed', rəbḥ 'winning', žəšm 'body' (Mitchell 1993:70 ff., Cohen 1975:74 ff.)

With regard to their treatment of phrase-final -CC clusters, VC-dialects fall into two areally discontinuous groups. The first group of dialects permits phrase-final -CC clusters only if they satisfy the sonority sequencing principle. Most Levantine dialects are of this type. The typical VC-dialect pattern is illustrated by the following examples from Tripoli (Kenstowicz and Abdul-Karim 1980):

[23]

a.	/ḥilm/	ḥilm	'dream'	ḥílim-na 3.Pl.Poss.	ḥílm-ak	2.P.Poss.
b.	/himl/	hímil	'load'	hímil-na	híml-ak	

A second group of VC-dialects permits no phrase-final -CC clusters at all. For example, Baghdad Christian Arabic (Abu-Haidar 1991) epenthesizes @ into a final cluster irrespective of sonority, and there seems to be no evidence of an underlying contrast between /CVC@C/ and /CVCC/:[18]

[24] a. kál@b 'dog', b@n@t 'girl', š@γ@b 'drink'

b. @s@m 'name', máṣ@γ 'Egypt', qám@l 'lice'

In Baghdad Jewish Arabic, on the other hand, epenthesis is sensitive to the sonority profile of the final cluster, and /CVC@C/ contrasts lexically with /CVCC/ (Mansour 1991:101 ff.):[19]

[25] a. /b@nt/ b@n@t 'daughter', /b@nt-a/ b@nta 'her daughter'

b. /ban-@t/ ban@t 'she built', /ban@t-a/ bn@ta 'she built it (F.)',

A number of writers report stylistic and sociolectal variation as to epenthesis in -RC clusters of falling sonority: (Palva 1966:35 and passim, Mitchell 1993:86 f., Haddad 1984).[20]

[26] a. /bint/ *bint* ∼ *binit* 'daughter', /fhim-t/ fhimt ∼ fhimit 'did you understand?', /dars/ dárs ∼ daris 'lesson'.

b. /ḥílm/ ḥílim 'dream', /jíbn/ jíbin 'cheese'.

A second point of variation is whether the inserted vowel counts for stress or not. In all CV-dialects, epenthetic vowels behave with respect to stress like ordinary vowels. In the majority of VC-dialects, epenthetic vowels are invisible to stress, both in that they do not get stressed themselves, and in that the syllable they head is 'skipped' in the calculation of stress. This is the case, for example, in Baghdad Jewish and Christian Arabic ([27a], Abu-Haidar 1991:34), and in the Anatolian dialect of Mardīn ([27b], Jastrow 1980b:144).

[18] Similarly the Egyptian dialects of the Eastern Delta region (Behnstedt & Woidich 1985, map 51).

[19] It appears that there is no covert contrast in those contexts in which epenthesis is obligatory, i.e. basically in clusters of rising sonority.

[20] According to Palva 1966:36, "the pronunciation of a consonant as syllabic [moraic, in my terms P.K.] is often heard in [Lower Galilean Palestinian] in elevated style and in learned borrowings. In colloquial, however, an epenthetic vowel is pronounced before a syllabic consonant."

[27] a. kál@b-ki ‘your dog’, b@n@t-k@m ‘your daughter’ @s@m-na ‘our name’

b. ák@l-na ‘our food’, @b@n-ki ‘your (f.) son’

But there are dialects in which the epenthetic vowel obligatorily counts for stress:

[28] ak@l-na ‘our food’, @b@n-ki ‘your (f.) son’ (Qartmīn, Jastrow ibid.):

In Baghdad Moslem Arabic, as well as in some Palestinian dialects, there is variation with respect to this point, with penult stress an option, e.g. /gil-t-la/ *gílitla* ∼ *gilítla* ‘I said to him’, ák@lna ‘our food’ > ak@lna, yúdurbu ‘he hits him’ > yudúrbu (Blanc 1953:28-29, Palva 1966:53, Erwin 1963, Mitchell 1993:82,194).

An epenthetic vowel that is stressable must be inserted lexically, either at the stem level or at the word level. We will assume the latter, though reanalysis of stem-level (underlying) representations should be kept in mind as a possibility (as suggested by Hamid 1984 for Sudanese nominal stems). In either case, we predict that such dialects will show no postlexical distinction between /CVC@C/ (or /CVCiC/) and /CVCC/. This prediction seems to be true in general.[21]

An interesting test case appears in the Palestinian dialect of the speaker studied by Johnson 1979. Here epenthesis shows special behavior in two specific classes of words. The larger consists of some morphologically defined types of nouns in -CC which undergo regular epenthesis even when the cluster is not of rising sonority. For stress and postlexical phonology, the vowel nevertheless counts as epenthetic. These include infinitives and active participles, e.g. dáres ‘studying’, versus the phonologically expected dárs ‘lesson’, and plurals of adjectives of color and defect, e.g. zorQ ‘blue’ (pl.). For this speaker, then, the moraic parsing of the final consonant in these specific classes of words is fixed lexically, perhaps in observance of some templatic constraint; adjectives of color and defect notoriously show a rigid template and special morphophonological behavior in Arabic.[22] The second set is very small, and contains obligatorily just the word kotob ‘book’ (and optionally also málek ‘king’). Here the vowel of the second syllable is invisible for purposes of word stress, like a normal epenthetic vowel (kótobna ‘our book’, like fóronna ‘our oven’), but it functions like an underlying vowel in the phrasal phonology (kótob el wálad ‘the boy’s book’, versus fórn el wálad). From the present point of view, this exceptional word must involve a lexical alternation between a bound allomorph /kotb/ in kótobna and a free allomorph /kotob/ in kótob el wálad.

The North African C-dialects would require special study, but a few inconclusive remarks may not be out of place here. According to phonetic descriptions, medial three-consonant clusters are either retained without epenthesis (yilbsu, yiktbu), or get a furtive phonetic transitional vowel on one or the other side of the middle consonant yík$^{@}$tbu, yíkt$^{@}$bu (Fischer & Jastrow 1980:65, Singer 1980:255). The latter happens typically when the cluster contains a sonorant or guttural, e.g. (Mauretanian) y@z$^{@}$rgu ‘they (will) ask’, y@d$^{@}$ḥlu ‘they (will) enter’, y@r$^{@}$dfu (Cohen 1963:90).[23]

[21] Epenthetic vowels count for stress in Soukhne Syrian (Behnstedt 1994) and in some parts of Upper Egypt (Behnstedt & Woidich 1985, map 3).

[22] For example, in Eastern Libyan they are systematically stressed on the initial syllable, unlike other words: *hábal* ‘foolish’, but *kitáb* ‘he wrote’.

[23] Cohen 1963 considers the transitional vowels to be phenomena of phonetic implementation, endorsing Cantineau’s statement that “phonologiquement, elles n’ont aucune existence réelle et sont tenues pour zéro par les sujets

When no epenthesis takes place, what is the syllable structure? One possibility is that consonants can be syllable peaks, at least on the phonetic level (Zawadowski 1978:50-51). Alternatively, the long consonant sequences of these dialects could be considered clusters rather than syllables (Mitchell 1993:72). The representation suggested here raises a third possibility, that they are moraic but unsyllabified consonants, i.e. semisyllables.

Auditorily, these dialects certainly have vowelless peaks. See Harrell 1962, where various analyses including voiceless schwa and empty nuclei are considered. In songs,[24] consonants (at least sonorants and voiceless fricatives) readily occupy beats. This could point to syllabic status, but a semisyllabic analysis cannot be excluded a priori.

My methodological starting point is that phonological rather than phonetic evidence is the key to the answer. Syllable structure, like stress, is a matter of prosodic organization and is not necessarily manifested directly in any single phonetic dimension. From comparative Slavic phonology (Liewehr 1967) it is clear that the difference between, say, a semisyllabic r and a syllabic r is not reliably identifiable from the phonetic record alone. The decisive considerations are whether it can or cannot be stressed, whether it can have an onset, whether it contributes to syllable and foot weight, etc. Moreover, a segment can be nonsyllabic in the lexical phonology and syllabic in the postlexical phonology, as the m of English rhythm.

Phonological evidence of this kind is not easy to come by. However, there are indications that sonorants can be syllable nuclei in Maghrebi Arabic, at least on some level. First, they can constitute the most sonorous segment of a word, as in Moroccan /d@rb/ [dr̩̈b] 'cul-de-sac' (Mitchell 1993:63). If the r in this word were not syllabic, then the word would have no syllable, or an empty nucleus, both options problematic. Secondly, sonorants are stressable, e.g. Marrakshi mš´r̩̈btha (Mitchell 1993:201).

Conversely, it seems that no word can consist entirely of obstruents, and that obstruents apparently cannot be stressed, so we might conclude that obstruents cannot form syllable peaks in Maghrebi, at least at the phonetic level. If obstruents could be syllabic, they should be capable of having onsets, and given these dialects' preference for closed syllables, they should have codas as well, predicting the possibility of words like *ktb, which do not seem to occur.

Cohen 1963:128 describes the following variation pattern for phrase-initial sonorants in Mauretanian Arabic.

[29]	a.	@nžr̩aḥt	*nžr̩aḥt	'I have been injured'
	b.	@nžar̩@ḥ@t	nžar̩@ḥ@t	'she has been injured'

On the assumption that Cohen's transcription @n represents syllabic [n̩̈] as described by Mitchell and others, and that n in a sonority peak position is a semisyllable, the distribution in [29] could be understood in the following way. Syllabification is obligatory before -CCV , because the nasal must be a syllable nucleus if it has to support a coda consonant, viz. nž.r̩@ḥ@t. Otherwise it is optionally syllabified, or remains a semisyllable (n̩̈.žar̩@ḥ@t ∼ n_{μ}.žar̩@ḥ@t). Under the assumptions stated, this would indicate variation between syllabic

parlants qui souvent n'ont pas conscience de les prononcer." (Cantineau 1946:179). Nevertheless, Cohen notes that the transitional vowel can be phonetically identical to phonemic @ though it never gets stressed in environments where a regular vowel would be stressed.

[24] For example, in recordings by the Algerian singer Dahmane el Harrachi.

and semisyllabic parsing of sonorants in sonority peak position, except when other constraints on syllable structure make the syllabic parsing obligatory.

Cohen also cites the following remarkable data for Mauretanian, virtually a reversal between underlying and output forms. In the 3SgM perfect, the citation form is monosyllabic (kt@b 'he wrote'), but in context a prothetic @ is usually inserted, unless the preceding word begins with a vowel, viz. @kt@b. In the imperative, the citation form is on the contrary disyllabic (@kt@b 'write!'), but the most frequent pronunciation in running speech, in all contexts, is monosyllabic kt@b. If the citation form is taken as the underlying form, we are in trouble, for how can we have /kt@b/ → @kt@b and at the same time /@kt@b/ → kt@b?

We can make some sense of this by positing the respective underlying forms /k@t@b/ 'he wrote' and /kt@b/ 'write!', with lexical epenthesis to @kt@b. The citation form can be identified with the output of the word-level phonology, derived by imposing on the underlying form the previously discussed constraint Reduce that bars light syllables. In the phrasal context, the perfect's initial C is joined into a syllable with a preceding vowel. The imperative is not subject to phrasal resyllabification, presumably because it initiates its own intonational group (as in English and in most languages), and only undergoes optional reduction to a monosyllable:

[30]		underlying	w.l., citation	C___	V__	
	Perfect	/k@t@b/	k_{μ}.t@b	C@k.t@b	Vk.t@b	'he wrote'
	Imperative	/kt@b/	@kt@b	@kt@b ∼ k_{μ}.t@b		'write! (MascSg)'

I tentatively conclude that sonorants in Maghrebi dialects may be syllabic if they are sonority peaks, and that they are otherwise at least optionally retained as semisyllables.

6 Opaque shortening of medial CVVC

The subject agreement endings in Arabic are introduced at the stem level of the lexical phonology, while object endings are word level. Before consonant-initial subject endings, the long vowel of CVVC- syllables is obligatorily shortened in all Arabic dialects, regardless of whether the final cluster is subject to epenthesis or not, e.g. Iraqi /gaal-t/ gilit, Egyptian /qaal-tu/ qultu 'I said'.[25] So *CVVC syllables are categorically prohibited everywhere in the stem-level phonology. More generally, the Ft-Bin constraint that prohibits feet exceeding the two-mora limit is undominated at the stem level.

The relationship between shortening before subject endings and epenthesis is opaque in all dialects (counterbleeding). For example, the 1.Sg. form corresponding to šaaf 'he saw', šif-na 'we saw' is šift or šuft; there are no dialects with forms such as *šaaf-it 'I saw'. This follows from the consonantal underlying form of the ending /-t/, if subject endings are assigned at the stem level in all dialects (as other facts of the phonology and morphology independently show). Epenthesis, on the other hand, is active only in the postlexical constraint system, or in some dialects at the word level, and therefore in either case intrinsically follows shortening.

[25] Long *-aa-* is shortened to *i* or *u*, or, in dialects that neutralize high vowels, to @ Historically, these long vowels are derived from -VCV- roots by loss of a medial glide or laryngeal, whose color originally determined the quality of the shortened root vowel.

With regard to the treatment of CVVC- syllables before object clitics and other word-level endings, dialects differ. VC- and C-dialects always retain the long vowel, or shorten it variably at the postlexical level,[26] and CV-dialects show three different treatments: shortening, epenthesis, and retention of the long vowel:

[31] /báab-ha/ 'her door'

a. VC- and C-dialects: báabha

b. CV-dialects

1. Shortening: bábha (Cairo, Delta)
2. Epenthesis: bàabiháa (alFarāfira, adDāxila), báabaha (Mecca)
3. Retention of CVVC-: báabha (Middle and Northern Upper Egypt, ilBaḥariyya)

In addition to object endings and possessive endings, a second class of word-level closed syllable shortening environments arises when medial syncope before vocalic word-level suffixes creates closed syllables, which are then shortened if long in the CV-dialects (Woidich 1980:213, Abu-Mansour 1991):

[32] a. CV-dialects: /kaatib-a/ → katba 'having written' (fem.), /ṣaaḥib-a/ → ṣaḥba 'female friend'

b. VC-dialects: /kaatib-a/ → kaatba, /ṣaaḥib-a/ → ṣaaḥba

The dialectal distribution of this second type of shortening tallies very closely with that of the first, as we would expect.

Next consider dialects where superheavy syllables that arise by morphological combination are eliminated by epenthesis, with preservation of the long vowel. They include two oasis dialects in Egypt (dialects (3e) and (3f) in [1]), and Makkan, where the epenthetic vowel is a, e.g. /Qumr-ha/ → *Qumraha*, /šuf-t-ni/ → *šuftani* (Abu-Mansour 1991:141).

The third solution is found in Middle Egyptian CV- dialects. In these dialects, superheavy syllables occur, but the restrictions on consonant clusters are the same as in other dialects (baabha but yiktibu). A similar system is found in Makkan (Abu-Mansur 1991).[27]

Typically, CVCC and CVVC syllables have a parallel status, and syllabification works to avoid both. Yet CVCC and CVVC do not behave in exactly the same way in all dialects; the former are more restricted. Also, syncope is allowed more readily after geminates than after other CC clusters, for shortening of long vowels and of geminates is a way of accommodating the syllable structure without incurring a melodic Max-violation. This is an instance of a "lookahead" effect of the sort that OT makes sense of.

The interplay of epenthesis and shortening in the resolution of overlength gives a measure of support for the LPM-OT approach to constraint interaction. Farwaneh (1995:152) notes that monomorphemic -CV endings, bimorphemic -C-V endings, and bimorphemic -C-CV

[26] In the Mesopotamian *q@ltu*-dialects it is an optional allophonic process, according to Jastrow 1978:212-213.

[27] Interestingly, this class of Egyptian CV-dialects (Behnstedt & Woidich 1985, map 74) includes all those dialects that lengthen *all* vowels under stress, apparently non-phonemically (Behnstedt & Woidich 1985, map 5), e.g. /bagaṛa/ *bá:gaṛa* 'cow', *gu:ṭṭa* 'cat' (*ibid.*, map 5).

endings all behave differently. In the Levantine dialects described by Abu-Salim (1982) and Haddad (1984), only monomorphemic -CV suffixes like those in [33b] allow the length of the preceding stem to surface:[28]

[33] a. Shortening before stem-level consonantal endings:

i.	/šaaf/	šaaf	'he saw'
ii.	/šaaf-t/	šífit	'I saw'
iii.	/šaaf-na/	šífna	'we saw'

b. No shortening before word level -CV endings:

i.	/beet-na/	béetna	'our house'
ii.	/nooQ-ha/	nóoQha	'its (f.) type'
iii.	/ʔiḥtaaj-ha/	ʔiḥtáajha	'he needed it (f.)'
iv.	/jaab-ha/	jáabha	'he brought her'

c. Shortening before word level -C-V endings:

i.	/jaab-l-i/	jábli	'he brought for me'
ii.	/jaab-l-u/	jáblu	'he brought for him'

d. Shortening before word level -C-CV endings (with epenthesis):

i.	/jaab-l-ha/	jábilha	'he brought for her'
ii.	/šaaf-l-ha/	šáfilha	'he saw for her'
iii.	/raah-l-ha/	ráhilha	'he went to her'

These data indicate that suffixation with -l triggers cyclic shortening of the resulting hyperlong (four-mora) syllable. This confirms that the word level can be cyclic, and that bound bases can constitute domains of constraint evaluation.

Farwaneh's South Palestinian dialect differs in having no shortening in the [33c] cases, e.g. jaablu (1995:162). A third group of dialects keeps the vowel long before all word-level endings, including cases like [33c] and [33d], e.g. Northern Iraqi Jewish Arabic baaQ-l-ú-me 'he sold them to him', jáab-@l-k@m 'he brought you (pl.)' (Jastrow 1990:59,325).[29]

A prediction of our analysis is that there should be no word-level closed syllable shortening before stressable epenthetic vowels. The reasoning that leads to this prediction is as follows. Because closed syllable shortening is lexical, it must be bled by lexical epenthesis, and it cannot be bled by postlexical epenthesis. The status of epenthesis as lexical or postlexical is independently determined by its interaction with word stress. Since stress is lexical, an epenthetic vowel that is stressable must be lexically inserted, and an epenthetic vowel that is unstressable must be postlexically inserted. So, closed syllable shortening should be bled by the insertion of stressable epenthetic vowels. This is confirmed by Soukhne Syrian kaalílha 'he said to her' (Behnstedt 1994:107), and by Iraqi jaabílha (alternating with jáabilha, see below) 'he brought to her' (Erwin 143, 41), with transparent constraint interaction (not *jabílha).

Conversely, since unstressable (postlexically inserted) epenthetic vowels are invisible at the word level, they should not block lexical closed-syllable shortening. And this is what we

[28] All these endings trigger shortening in all CV-dialects, of course, e.g. Egyptian /raaḥ-l-ha/ *raḥlaha* 'he went to her'.

[29] Farwaneh accounts for the data in [33] by supposing that monoconsonantal suffixes like *-l* are underlyingly moraic, an ad hoc solution which in any case does not extend to the other variations on the shortening theme.

find e.g. in Levantine jaab-l-ha → (word level) jábl$_\mu$ha → (postlexical) jábilha. Thus the intrinsic serial relation of the levels enforces opaque (counterbleeding) constraint interaction.

In dialects with general pre-stress shortening, the root vowel is of course short even before a stressable epenthetic vowel. For example, all Egyptian dialects have pre-stress shortening (Fischer/Jastrow 1980:213), evidently at the word level. Hence Egyptian dialects which stress epenthetic vowels do shorten before those vowels, e.g. il-Bi'raat jabílhum (Woidich 1973-4:365). Blanc 1953:44,75 explicitly give this analysis for North Palestinian examples like /ḥmaar-t-ku/ ḥmarítku 'your female donkey'. Similarly, the Benghazi Libyan jabílha (Farwaneh 1995:141) may really be jaabílha with the variable phonetic shortening of unstressed vowels described by Owens (1984:30) for a closely related Libyan dialect (1984:30).[30]

The prediction is that dialects retain length before unstressable epenthetic vowels only if they tolerate hyperlong syllables. This is confirmed by data from Eastern Libyan (Owens 1984), which admits final hyperlong syllables in the output, and apparently also retains medial hyperlong configuration -CVVC-C- in cases like [33c] in spite of postlexical epenthesis:

[34] ma šif-nā-k-š 'we didn't see you' (Owens 1984:158)
ma inQ́ām-š 'not swimmable' (124)
dāff 'has pushed' (24)
gṓl-il-ha, from /gaal-l-ha/ 'he said to her' (inferred from 33,105,113)

Perhaps structures like [34] are prosodically accommodated by licensing two semisyllables in a row at the word level.[31]

The dialect data are very complex, but they seem compatible with the prediction that closed syllable shortening is bled by lexical epenthesis. Apparent cases of counterbleeding are attributable to independently motivated word-level or postlexical processes that shorten unstressed syllables. This would tend to further support the claim that interaction of phonological processes is transparent within a level, and that opacity effects arise from inter-level serialism.

7 Summary

I have argued that certain Arabic dialects permit consonants to form unsyllabified moras (onsetless "semisyllables") in the word-level phonology. These moras are licensed by adjunction to the prosodic word. Semisyllables persist into the output in certain contexts in C-dialects, in part accounting for the Berber-type syllable structure of these dialects. In VC-dialects an epenthetic vowel is inserted before them as a nucleus postlexically, rendering lexical processes such as stress and shortening opaque. Faithfulness requires that the

[30] Allophonic and/or variable shortening of unstressed vowels is attested for other dialects, see e.g. Fleisch 1947-48:60 on Zaḥle (Lebanon), Johnson 1979 on Palestinian, and Cohen 1975:55 on 'half-long' vowels in Moroccan Jewish Arabic.

[31] Syrian shows variation: /žaab-l-na/ *žáab@lna* 'he brought to us' (Cowell 1964:481), /ma-ktuub-l-ak/ *makt@blak* 'written to you (masc.)' (Grotzfeld 1965:42), cf. /ma kaan-š/ *makanš* (Grotzfeld 1980:178), Soukhne Syrian *maa bi-šuuf-š* 'he doesn't see anything' (Behnstedt 1994:162). Iraqi shows stress variation in case of epenthesis, e.g. *ʔíbin-ha* ∼ *ʔibín-ha* 'her son' (Erwin 1963:41); no shortening is reported for forms like *jáabla, jáabilha* ∼ *jaabílha* (*ibid* 143). I was unable to find consonantal word-level suffixes like -š in Iraqi to test the prediction.

epenthetic vowel be placed *before* the consonant, so as to maintain its moraic character and to minimize changes in the foot structure of the word. In CV dialects, a Licensing constraint requiring moras to be affiliated with syllables ranks higher, ruling out semisyllables in general. Unsyllabifiable consonants never become moraic, but get an epenthetic vowel after them (its place again dictated by prosodic Faithfulness). The characteristic syllabic differences between the dialects can largely be explained from these assumptions.

Bibliography

Abu-Haidar, Farida. 1991. Christian Arabic of Baghdad. Wiesbaden: Harrassowitz.

Abu-Mansour, Mahasen. 1991. Epenthesis in Makkan Arabic: Unsyllabifiable consonants versus degenerate syllables. Mushira Eid and John McCarthy, Perspectives on Arabic Linguistics III: Papers from the third annual symposium on Arabic linguistics. 137-159. Amsterdam: John Benjamins.

Abu-Mansour, Mahasen. 1992. Closed Syllable Shortening and morphological levels. Mushira Eid and John McCarthy, Perspectives on Arabic Linguistics IV: Papers from the fourth annual symposium on Arabic linguistics. 47-76. Amsterdam: John Benjamins.

Abu-Salim, Issam. 1980. Epenthesis and geminate consonants in Palestinian Arabic. Studies in Linguistic Sciences 10: 1-12.

Aquilina, Joseph. 1959. The structure of Maltese. Valletta: Royal University of Malta.

Bagemihl, Bruce. 1991. Syllable structure in Bella Coola. LI 22: 589-646.

Behnstedt, Peter and Manfred Woidich. 1985. Die ägyptisch-arabischen Dialekte. Wiesbaden: L. Reichert.

Behnstedt, Peter. 1985. Die nordjemenitischen Dialekte. Teil 1: Atlas. Wiesbaden: L. Reichert.

Behnstedt, Peter. 1994. Der arabische Dialekt von Soukhne (Syrien). Wiesbaden: Harrassowitz, 1994.

Blanc, Haim. 1953. Studies in North Palestinian Arabic; linguistic inquiries among the Druzes of western Galilee and Mt. Carmel. Oriental Notes and Studies, No. 4. Jerusalem: Israel Oriental Society.

Booij, Geert. 1997. Non-derivational phonology meets Lexical Phonology. In Iggy Roca (ed.) Derivations and constraints in the lexicon. Oxford: Clarendon Press.

Brame, Michael. 1974. The cycle in phonology: stress in Palestinian, Maltese and Spanish,' Linguistic Inquiry, 5.39-60.

Broch, Olaf. 1912. Slavische Phonetik. Heidelberg: Winter.

Broselow, Ellen. 1992. Parametric variation in Arabic dialect phonology. Mushira Eid and John McCarthy, Perspectives on Arabic Linguistics IV: Papers from the fourth annual symposium on Arabic linguistics. 1-42. Amsterdam: John Benjamins.

Broselow, Ellen. 1976. The phonology of Egyptian Arabic. Ph.D. dissertation, University of Massachusetts, Amherst.

Broselow, Ellen. 1982. On Predicting the Interaction of Stress and Epenthesis. Glossa 16.115-132.

Broselow, Ellen. 1980. Syllable structure in two Arabic dialects. Studies in the Linguistic Sciences 10 ed. by Michael Kenstowicz, 13-24. Urbana: Department of Linguistics, University of Illinois.

Broselow, Ellen. 1979. Cairene Arabic Syllable Structure. Linguistic Analysis 5.345-382.

Buckley, Eugene. 1994. Theoretical aspects of Kashaya phonology and morphology. Stanford: CSLI.

Bye, Patrik. 1997. Representing 'overlength': Against trimoraic syllables. In Geert Booij and Jeroen van der Weijer (eds.) Phonology in progress — Progress in phonology. HIL Phonology Papers III. The Hague: Holland Academic Graphics.

Cantineau, Jean. 1946. Les parlers arabes du Hôrân. Vol. 2. Paris: C. Klincksieck.

Cho, Young-mee Yu and Tracy Holloway King. 1996. Semi-syllables and Georgian clusters. TREND VI, Stanford University.

Clements, G. N. 1997. Berber syllabification: derivations or constraints? In I. Roca (ed.) Constraints and derivations in phonology, 289-330. Oxford: Oxford University Press.

Clements, George N. and Samuel Jay Keyser . 1983. CV Phonology: a generative theory of the syllable. Cambridge, MA.: MIT Press.

Cohen, David. 1963. Le dialecte arabe Hassaniya de Mauritanie (parler de la Gabla). Paris, C. Klincksieck.

Cohen , David. 1975. Le parler arabe des juifs de Tunis. Vol. 2. Paris: Mouton.

Cowell, Mark W. 1964. A reference grammar of Syrian Arabic, based on the dialect of Damascus.

Dell, François and O. Tangi. 1993. On the vocalization of /r/ in Ath-Sidhar Rifian Berber", Linguistica Communicatio V.5-53.

Dell, François and O. Tangi. 1992. Syllabification and empty nuclei in Ath-Sidhar Rifian Berber. Journal of African Languages and Linguistics 13.125-162.

Dell, François and Mohamed Elmedlaoui. 1985. Syllabic Consonants and Syllabification in lmdlawn Tashilhiyt Berber. Journal of African Languages and Linguistics 7.105-130.

Dell, François and Mohamed Elmedlaoui. 1988. Syllabic consonants in Berber: Some new evidence. Journal of African Languages and Linguistics 10.1-17.

Dell, François and Mohamed Elmedlaoui. 1996a. On consonant releases in Imdlawn Tashlhiyt Berber. Linguistics 34.357-395.

Dell, François and Mohamed Elmedlaoui. 1997. La syllabation et les géminés dans la posie berbère du Maroc (dialecte chleuh). Cahiers de grammaire 22.1-95.

Dell, François and Mohamed Elmedlaoui. 1996b. Nonsyllabic transitional vocoids in Imdlawn Tashlhiyt Berber. In J. Durand and B. Laks, eds., Current Trends in Phonology: Models and Methods, 219-246. European Studies Research Institute, University of Salford.

Downing, Laura J. 1998. On the prosodic misalignment of onsetless syllables. Natural Language and Linguistic Theory 16: 1-52.

Erwin, Wallace M. 1963. A short reference grammar of Iraqi Arabic. Washington: Georgetown University Press

Fabri, Ray. 1999. Radicals, roots, stems, and the lexicon. Paper presented at the Second Mediterranean Morphology Meeting, Malta.

Farwaneh, Samira. 1995. Directionality effects in Arabic syllable structure. Ph.D. Dissertation, University of Utah.

Fischer, Wolfdietrich, and Otto Jastrow. 1980. Handbuch der arabischen Dialekte. Wiesbaden: Otto Harrassowitz.

Fleisch, Henri. 1947-48. Notes sur le dialecte arabe de Zaḥlé (Liban). MUSJ 27. Page references to the reprint in Fleisch 1974.

Fleisch, Henri. 1974. Etudes d'arabe dialectal. Beyrouth: Dar el-Machreq.

Grotzfeld, Heinz. 1965 Syrisch-arabische Grammatik. Wiesbaden: Harrassowitz.

Haddad, Ghassan F. Epenthesis and sonority in Lebanese Arabic. Studies in the Linguistic Sciences 14.57-87.

Hagstrom, Paul. 1997. Contextual metrical invisibility. MIT Working Papers in Linguistics 30, also Rutgers Optimality Archive 219.

Han, Eunjoo. 1994. Prosodic structure in compounds. Ph.D. Dissertation. Stanford University.

Harrell, Richard S. 1965. A basic course in Moroccan Arabic. Washington, Georgetown University Press.

Harrell, Richard S. 1962a. A short reference grammar of Moroccan Arabic. Washington, Georgetown University Press.

Harrell, Richard S. 1962b. Consonant, vowel, and syllable in Moroccan Arabic. In A. Sovijärvi (ed.) Proceedings of the Fourth International Congress of the Phonetic Sciences. The Hague: Mouton.

Hart, M. E. 1991. The moraic status of initial geminates in Trukese. BLS 17.107-120.

van der Hulst, Harry, and Nancy Ritter. 1998. Kammu minor syllables in Head-driven Phonology. In Eugeniusz Cyran and Piotr Stalmaszczyk (eds.) Structure and interpretation. Studies in phonology. Lublin: Wydawnictwo FOLIUM.

Hume, Elizabeth, Jennifer Muller, and Aone van Engelenhoven. 1997. Nonmoraic geminates in Leti. Phonology 14.371-402.

Hyman, Larry. 1985. A theory of phonological weight. Dordrecht: Foris.

Irshied, Omar, & Michael Kenstowicz. 1984. Some phonological rules of Bani-Hassan Arabic: A Bedouin dialect. Studies in the Linguistic Sciences 14: 109-147.

Itô, Junko. 1986. Syllable theory in prosodic phonology. Ph.D. Thesis, University of Massachusetts.

Itô, Junko. 1989. A prosodic theory of epenthesis. Natural Language and Linguistic Theory 7.217-259.

Itô, Junko & Armin Mester. 1992. Weak layering and word binarity. Linguistics Reserarch Center Report 92-09. University of California, Santa Cruz.

Jastrow, Otto. 1973. Daragözü, eine arabische Mundart der Kozluk-Sason-Gruppe (Südostanatolien). Nuernberg: H.Carl.

Jastrow, Otto. 1978. Die mesopotamisch-arabischen qəltu-Dialekte. Wiesbaden: Steiner.

Jastrow, Otto. 1980a. Die Dialekte der arabischen Halbinsel. In Fischer and Jastrow 1980.

Jastrow, Otto. 1980b. Das mesopotamische Arabisch. In Fischer and Jastrow 1980.

Jastrow, Otto. 1990. Der arabische Dialekt der Juden von Aqra und Arbil. Wiesbaden: Harrassowitz.

Johnson, C. Douglas. 1979. Opaque stress in Palestinian. Lingua 49: 153-168.

Kager, René. 1992 [1989]. A metrical theory of stress and destressing in English and Dutch. Dordrecht: Foris.

Kager, René. 1999. Surface opacity of metrical structure. In B. Hermans and M. van Oostendorp (ed.) The derivational residue in phonology, 207-245. Amsterdam: Benjamins.

Kenstowicz, Michael, and Kamal Abdul-Karim. 1980. Cyclic Stress in Levantine Arabic. Studies in the Linguistic Sciences 10: 55-76.

Kenstowicz, Michael. 1981. A note on cyclic structure in Levantine Arabic. Epenthesis and degenerate syllables in Cairene Arabic. Hagit Borer and Youssef Aoun (edd.) Theoretical issues in the grammar of Semitic languages. MIT Working Papers in Linguistics 3.

Kenstowicz, Michael. 1983. Parametric variation and accent in the Arabic dialects. CLS 19: 205-213.

Kenstowicz, Michael. 1986. Notes on syllable structure in three Arabic dialects. Revue Québecqoise de linguistique 16.101-128.

Kenstowicz, Michael. 1996. Base-identity and uniform exponence: alternatives to cyclicity. In J. Durand and B. Laks (edd.) Current trends in phonology: models and methods, 363-393. Salford: European Studies Research Institute.

Kiparsky, Paul. To appear. Paradigm effects and opacity. Stanford: CSLI.

Kirchner, R. 1996. Synchronic chain shifts in Optimality Theory. LI 27:341-350.

Levin, Juliette. 1985. A metrical theory of syllabicity. Ph.D. dissertation. MIT.

Liewehr, F. 1967. Zur Entstehung und Behandlung der Nebensilbigkeit im Slavischen. Zeitschrift für Slawistik 12: 708-726.

Lin, Yen-Hwei. 1997. Syllabic and moraic structures in Piro. Phonology 14: 404-436.

Mansour, Jacob. 1991. The Jewish Baghdadi dialect. Or-Yehuda: The Babylonian Jewry Heritage Center.

Marçais, Philippe. 1977. Esquisse grammaticale de l'arabe maghrébin. Paris: Librairie d'Amérique et d'Orient.

McCarthy, John. 1998c. Morpheme structure constraints and paradigm occultation. MS.

McCarthy, John. 1999. Serialism, OT, and the Duke-of-York Gambit. Rutgers Optimality Archive.

McCarthy, J., and A. Prince. 1993. Prosodic Morphology I. Constraint Interaction and Satisfaction. Ms. University of Massachusetts, Amherst and Rutgers University, New Brunswick. To appear, MIT Press.

Mester, Armin and Jaye Padgett. 1994. Directionality in generalized alignment. Phonology at Santa Cruz 3.79-85.

Mitchell, T. F. 1960. Prominence and syllabification in Arabic. BSOAS 23.369-389.

Mitchell, T. F. 1993. Pronouncing Arabic, Vol. 2. Oxford: Clarendon Press.

Mutaka, Ngessimo, and Larry Hyman. 1990. Syllable and morpheme integrity in Kinande reduplication. Phonology 7:73-120.

Nespor, Marina, and Irene Vogel. 1986. Prosodic phonology. Dordrecht: Foris.

Nishio, Tetsuo. 1994. The Arabic dialect of Qifṭ (Upper Egypt): grammar and classified vocabulary. Tokyo: Institute for the Study of Languages and Cultures of Asia and Africa.

Odden, David. 1995. Onsetless syllables in Kikerewe. OSU Working papers in linguistics 41:46-84.

Owens, Jonathan. 1984. A short reference grammar of Eastern Libyan Arabic. Wiesbaden: O. Harrassowitz.

Owens, Jonathan. 1980. The syllable as prosody: a reanalysis of syllabification in Eastern Libyan Arabic. BSOAS 43: 277-287.

Owens, Jonathan. 1993. A grammar of Nigerian Arabic. Wiesbaden: Harrassowitz.

Palva, Heikki. 1966. Lower Galilean Arabic: an analysis of its anaptyctic and prothetic vowels with sample texts. Helsinki. Studia Orientalia 32.

Potter, Brian. 1994. Serial optimality in Mohawk prosody. CLS 30.

Prince, Alan and Paul Smolensky. 1993. Optimality theory: Constraint interaction in generative grammar. Ms., Rutgers University and U. of Colorado.

Prochazka, Theodore. 1988. Saudi Arabian dialects. London: Kegan Paul International.

Redford, Michael. 1996. Some Aspects of Sudanese Colloquial Arabic Phonology. MA Thesis. Universität Konstanz.

Rubach, Jerzy & Geert Booij. 1990. Syllable structure assignment in Polish. Phonology 7:121-158.

Selkirk, Elizabeth. 1981. Epenthesis and degenerate syllables in Cairene Arabic. Hagit Borer and Youssef Aoun (edd.) Theoretical issues in the grammar of Semitic languages. MIT Working Papers in Linguistics 3.

Selkirk, Elizabeth. 1995. The prosodic structure of function words. In Jill N. Beckman, Laura Walsh Dickey and Suzanne Urbanczyk (eds.) Papers in Optimality Theory, p. 439-469. University of Massachusetts Occasional Papers, 18; GLSA, UMass Amherst.

Shaw, Patricia. 1993. The prosodic constituency of minor syllables. WCCFL 12:117-132.

Singer, Hans-Rudolf. 1980. Das Westarabische oder Maghribinische. In Fischer and Jastrow 1980.

Svantesson, Jan-Olof. 1983. Kammu phonology and morphology. Lund: Liber Förlag.

Woidich, Manfred. 1973-4. Die 3. Person Feminin Singular Perfekt in dem Oberägyptischen Dialekt von il-Bi‘rāt. Beyrouth: Imprimerie catholique.

Woidich, Manfred. 1974. Ein arabischer Bauerndialekt aus dem südlichen Oberägypten. ZDMG 124.42-58.

Zawaydeh, Bushra Adnan. 1998a. On an optimality-theoretic account of epenthesis and syncope in Arabic dialects. In Mushira Eid and Robert Ratcliffe, Perspectives on Arabic linguistics X: Papers from the tenth annual symposium on Arabic linguistics. 191-213. Amsterdam: Benjamins.

Zec, Draga. 1988. Sonority constraints on prosodic structure. Ph.D. dissertation, Stanford University.