A Concatenative Approach to Semitic Templatic Morphology *

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Abstract

In the nonconcatenative morphology of Semitic languages, syntactic features can be realized by prosodic changes to a stem. The degree to which phonology controls the word shape and nonconcatenative morphological alternations in these languages has been up for debate ever since the first autosegmental account of Arabic morphology related the two by mapping morphemes non linearly onto stored prosodic templates (McCarthy 1981). This article, however, argues that seemingly nonconcantenative morphology is indeed best represented concatenatively as discrete phonological pieces realizing morphosyntactic features. The resulting morphophonological effects can be separated from prosodic factors that affect the entire word. In support of this hypothesis, I examine locality effects in allomorphy selection and the interaction of morphophonological and phonological processes in the Semitic languages Arabic and Akkadian, showing that in both cases, apparently nonconcatenative morphemes in fact show structural sensitivity, which can only be captured in a piece based theory of morphology where realization of syntactic features is separate from phonological constraints.

Keywords: nonconcatenative templatic morphology, morphophonological lengthening, Arabic, Akkadian, locality

1 Introduction

The non linear morphology of Semitic languages provides important evidence for how syntax and phonology can interact. Words in these languages have no obvious concatenative structure, but are derived from a discontinuous morpheme, the consonantal root, which appears interleaved with the consonants and vowels of other morphemes. For example, the classical Arabic root $\sqrt{}$KTB appears in kataba 'he wrote', ktataba 'he copied', kutiba 'it was written', maktabun 'office (nom.)', etc. Semitic morphology is also described as templatic due to the relatively fixed word shapes and use of prosodic changes such as lengthening to indicate grammatical differences (e.g. kataba 'he wrote', kattaba 'he made someone write').

Prosodic and non linear effects are most easily described with reference to the output shape of the entire word, which would seem to be the domain of the phonological grammar, raising questions for morpheme-based theories. One possible approach is for an output oriented phonological grammar to control morphophonological effects. Recently, this kind of phonologically templatic analysis of Semitic morphology has taken the form of morpheme-specific OT prosodic constraints (e.g. Tucker 2010).

The opposite theoretical approach equates Semitic with more familiar concatenative languages, building words from discrete phonological pieces according to their morphosyntactic structure. In support of this, I analyze theme vowel allomorphy in Iraqi and Gulf Arabic and in the East Semitic language Akkadian as well as the interaction of syncope and gemination in Akkadian, showing that in both cases, the morphophonological process of lengthening shows locality effects which are sensitive to the morphosyntactic structure of the verb. Prosodic constraints in these languages can create a templatic appearance by influencing the output shape of the morphologically complex word or by blocking the surface realization of a morpheme, but these constraints are independent of the spell-out of these morphemes themselves. These facts can be captured in an account where lengthening is caused by a morpheme whose phonological exponent is a moraic autosegment. On the other hand, a phonologically templatic analysis fails since it cannot separate lengthening from constraints on word output shape or make reference to morphosyntactic locality.

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1.1 A Note on Terminology

The word "template" has been used with varying senses in the Semitic and Linguistics literature, thus some clarification is in order. I will use the word "template" to refer to a fixed prosodic shape for a particular morphological form, which despite being confounded with nonconcatenative morphology in Semitic languages, is logically and empirically distinct from it. This type of templatic effect occurs outside of Semitic in languages within reduplicative morphology, where the content of a particular morpheme is a copy of stem material, but prosodic constraints can require, for example, that the reduplicative morpheme be a single light syllable (McCarthy and Prince 1994).

Sometimes the word "template" is used in the literature on Semitic to refer to the entire word pattern (e.g. Doron 2003, see also Harris 1941). The traditional names for different verbal forms are based on the word patterns exclusive of inflectional affixes: for example in [tʃaawar] the word pattern would be $tC_1aaC_2aC_3$, where the three numbered C's refer to the three consonants (radicals) of the root (in this case ʃ, w, r). This terminology obscures the discrete morphological structure that comprises these word patterns.

There are also effects described as templatic that hold statically of a language, such as a prosodic word being minimally two morae, or the fact that roots are CVC in Mayan languages (McCarthy 1989). The restriction that Semitic roots consist solely of two to four consonants is an effect of this type (McCarthy 1981), but will not be the focus of this paper.

1.2 Outline of Argument

The argument in this paper will proceed as follows: Section 2 will briefly present a theoretical framework for the syntax-phonology interface and outline my assumptions about the basic morphosyntactic structure of verbs in Arabic and Akkadian. I will also sketch how the basic form of the verb is derived; Section 3 will analyze the nonconcatenative processes of morphophonological lengthening in the two languages, arguing that it is best understood as immobile infixation of an autosegmental affix; Section 4 will analyze the cyclic interaction of gemination and syncope in Akkadian, showing that it depends on the morphosyntactic structure of the verb; Section 5 will show that locality effects in stem vowel allomorphy in Arabic and Akkadian provides evidence that even apparently nonconcatenative morphemes must be concatenated according to their morphosyntactic position before being positioned by the phonology; Section 6 will show how templatic effects can arise from the application of purely phonological constraints to morphologically complex inputs; Section 7 will conclude.

2 Background: Theoretical Framework

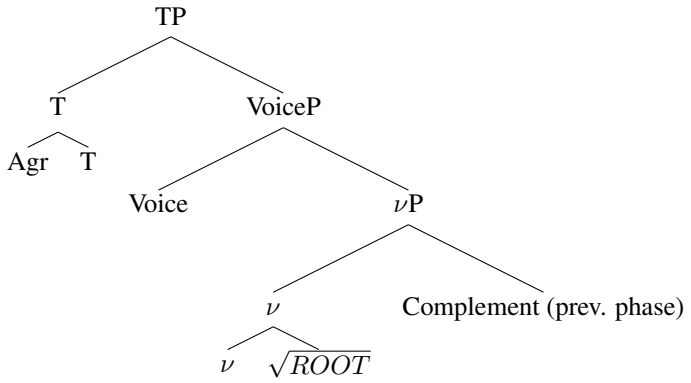
2.1 The Syntax-Phonology Interface

As a starting point for investigating the nature of interaction between the morphosyntactic and phonological components of the grammar, I will outline some assumptions about how these components work. These assumptions will allow me to analyze interactions between these components in Arabic in Akkadian which other theoretical frameworks cannot capture.

This paper argues for a framework in which even nonconcatenative morphology is derived from discrete nodes of syntactic structure. Following work in Distributed Morphology (DM, Halle and Marantz 1993), verbs are derived by combining an abstract acategorial root with a categorizing little ν head. This little ν head can simply be an unmarked verbalizer, or can carry additional syntactic features such as causative or inchoative, which can correspond to different morphemes (Folli and Harley 2005). Other verbal heads such as Voice and Mood attach outside this complex, followed by inflectional material such as tense and agreement.

As discussed in Marantz (2013), little ν is a phase head which triggers spell-out of the verbal complement, but not the verb root. Rather, allomorphy effects show that the root and little ν must be spelled out together along with the entire extended verbal projection in the next cycle triggered by the merger of the C phase head:

(1)



By the hypothesis of Phase Theory (Chomsky 2001), a single spell-out domain such as the one above is the only place where syntactic features and their phonological realizations are both available to the grammar at once, and thus serves as a local domain for the interaction of morphology and phonology. We will see that this is also the relevant domain for allomorphy in Semitic verbs.

I assume that vocabulary insertion happens in the morphological component of the grammar which is separate from the phonological grammar contra e.g. Wolf (2008)'s theory of Optimal Interleaving or any theory that uses phonological constraints to choose allomorphs. The output of the morphological component is then interpreted by an Optimality Theoretic (OT) phonological grammar, which does not have access to structural information.

This paper will assume that verb formation in both Arabic and Akkadian uses as its basis a consonantal root, as has been argued for Arabic and Hebrew on the basis of linguistic evidence by McCarthy (1981), Arad (2005), Tucker (2011) inter alia, and for Arabic, Hebrew and Maltese on the basis of psycholinguistic evidence by Frost et al. (1997), Boudelaa and Marslen-Wilson (2003, 2005), Twist (2006), Idrissi et al. (2008). This contrasts with a stem-based approach (Bat-El (1989), Ussishkin (2003) inter alia), where, for example, the Hebrew causative verb gidel 'he raised' is derived from gadal 'he grew (intrans)' by melodic overwriting instead of both verbs being derived from the common root morpheme $\sqrt{gdl}$.

2.2 Arabic Morphosyntax

I will base my description of Arabic verbal morphology on the morphosyntactic analysis of Emirati-Gulf Arabic given by Al-Kaabi (2011), who argues that the verb patterns result from realizations of different features on the little ν head combined with realizations of features on a higher Voice head (see Section 2.1).[1] As can be seen in the table below, the morphological contributions of little ν and Voice can be separated: the features on Voice are realized as a segmental prefix or infix (/n-/ for the passive, /t-/ for the middle/reflexive), while features on little ν are realized by lengthening (of the first vowel in the applicative) or gemination (of the middle or final radical in the causative and inchoative respectively). Since no one root appears in all forms, I have used the verb [faʕal] 'do', which is a commonly used citation verb:

(2)

	Little ν (∅)	Little ν (Causative)	Little ν (Applicative)	Little ν (Inchoative)
Voice (∅)	$C_1VC_2VC_3$ I: *faʕal*	$C_1VC_2C_2VC_3$ II:*faʕʕal*	$C_1VVC_2VC_3$ III: *faaʕal*	$C_1C_2VC_3C_3$ IX: *fʕall*
Voice (Passive)	n$C_1VC_2VC_3$ VII: n*faʕal*	-	-	-
Voice (Middle/Reflexive)	C_1tVC_2VC_3 VIII: *ftaʕal*	t$C_1VC_2C_2VC_3$ V: *tfaʕʕal*	t$C_1VVC_2VC_3$ VI:*tfaaʕal*	-

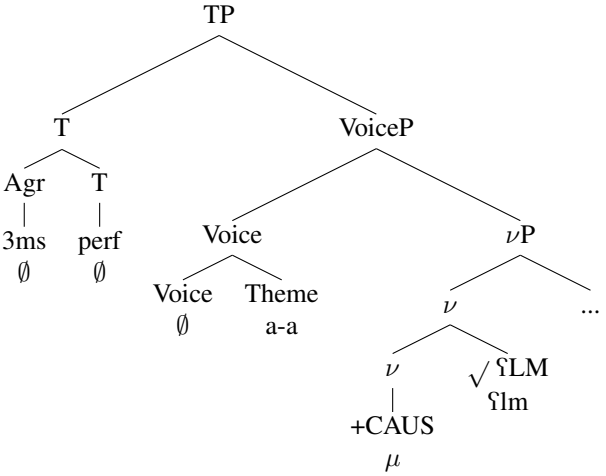
Verbal forms will be referred to by the syntactic features of their morphemes. For example, what is traditionally called Form II will be the causative, since it results from the root combining with a causative little ν morpheme. The vowels represented by V prosodic positions are theme vowels with no syntactic function.

[1] While word patterns in Semitic languages are famous for being semantically idiosyncratic, I will follow work by Doron (2003), Arad (2005), Al-Kaabi (2011) in assuming that a single pattern is derived from a consistent set of morphosyntactic features. My analysis only depends on the fact that any given morphological form has a uniform morphosyntactic make-up, and how idiosyncratic semantic interpretations arise is not important here.

This paper will focus mostly on verbal stems, and thus the table above gives all of the relevant forms. However, these stems also combine with tense/aspect and agreement affixes. Arabic has two tense/aspects, the perfective and the imperfective. Since the third person agreement affix is null in the perfective, it is possible for a verb to be a bare stem, and thus this will be most often used as the citation form.

Below is an example of the verb structure I assume with the spell-out of every morpheme for an Arabic causative verb indicated below the morphosyntactic feature it corresponds to:

(3) 3ms perfective causative verb [ʕallam], 'he taught'



The causative little ν is represented as a mora (μ) which geminates the second radical of the root (see Section 3). The independence of the stem (theme) vowels and their position is discussed in Section 5.

2.3 Akkadian Morphosyntax

Since Akkadian, as a related language, has verbal morphology very similar to Arabic, a similar analysis should apply. Like Arabic, the basic verbal form (traditionally called the G-stem) has no overt realization of little ν or Voice. Akkadian also has two different verbal forms which can have a causative meaning: one called the Š-stem because it has a prefix /ʃa-/ and the other called the D-stem because it has doubling (gemination) of the second radical of the root (like the Arabic causative Form II). Although these two forms overlap in meaning, it is unlikely that they are allomorphs of the same morpheme, since they also have distinct uses (for example the D form can indicate a plurality of objects), and the same root can appear in both forms with a different meaning (Huehnergard 2005). I will assume that they correspond to different features on little ν and will call the D-stem the intensive (following the literature on Hebrew) and the Š-stem the causative for the purposes of this paper.

There is also a passive form, traditionally referred to as the N-stem because it has a prefix /n(a)-/. I will assume this corresponds to a passive feature on the Voice node. The set of Akkadian stems is given below with hypothesized underlying forms:

(4) Akkadian verbal stems

	Little ν (∅)	Little ν (Intensive)	Little ν (Causative)
Voice (∅)	$C_1VC_2VC_3$ G: /-sʔabat/	$C_1VC_2C_2VC_3$ D: /-sʔabbat/	ʃa$C_1VC_2VC_3$ Š: /-ʃasʔabat/
Voice (Passive)	n$C_1VC_2VC_3$ N: /-nsʔabat/	-	-

Akkadian verbs can occur in one of three aspects: the perfective (traditionally the preterite), which has no overt affix, the imperfective (traditionally the durative), which is marked by gemination of the middle radical of the root, and the perfect, which is marked by an infix /-t-/. The citation form is the 3rd masculine singular, which is marked with an /i-/ agreement prefix in the basic (G) stem (e.g. isʔabat) or a /u-/ agreement prefix in derived stems (e.g. usʔabbat).

2.4 Deriving the Basic Form of the Verb

The phonological shape of the Basic Form of the Verb in both Arabic and Akkadian can be derived as the default prosodification of the consonantal root with the theme vowels, which leads to both morphemes being discontinuous in the output. Since the input morphemes will always be a consonantal root and the theme vowels, using phonological constraints to determine the arrangement of the consonants and vowels into feet derives the fact that all of these verbs have the same prosodic structure without additional stipulation. Unless otherwise noted, the sources for the examples given in this paper are Gulf Arabic as described by Qafisheh (1977), Iraqi Arabic as described by Erwin (2004) and the Old Babylonian dialect of Akkadian as described in Huehnergard (2005).

2.4.1 The Basic Form in Arabic

The surface form of the basic stem in Iraqi and Gulf Arabic is $C_1VC_2VC_3$ for triliteral verbs where the three numbered C's represent the radicals of the root and the V's are the theme vowels:

(5) Basic Triliteral Verbs in Iraqi Arabic

Verb	Root	
ʔaxað	ʔxð	'he took'
kitab	ktb	'he wrote'
jibas	jbs	'it dried (intrans)
wusˤal	wsˤl	'he arrived'

These forms have an unmarked syllable structure for the language with no complex margins. Tucker (2010) makes this observation, concluding that this form is not only a default verbal form, but also a default phonological structure. Besides the regular triliteral roots, Arabic also has roots that consist of two or four consonants. These too have a default prosodic structure in the Basic Form. Quadriliterals in both Gulf and Iraqi Arabic have the form $C_1VC_2C_3VC_4$:

(6) Basic Quadriliteral Verbs in Iraqi Arabic

Verb	Root	
barhan	brhn	'he proved'
traʤam	trʤm	'he translated'
xarmaʃ	xrmʃ	'he scratched'

In order to arrange four root consonants with still only two theme vowels, the root is syllabified with a medial coda, but still no complex clusters.

Biliterals in both dialects have the form $C_1VC_2C_2$:

(7) Biliteral Verbs in Iraqi Arabic

Verb	Root	
zabb	zb	'he liked'
ɣaʃʃ	ɣʃ	'he cheated'
wann	wn	'he moaned'

Tucker (2010) has shown for Iraqi Arabic that the prosodic word is minimally bi-moraic, an observation also made by Watson (2002) for other dialects of Arabic. Since word-final consonants do not count towards weight (see also Section 6.1.1) word final consonant gemination is a process that applies across the language (e.g. /ʕab/ → [ʕabb], 'father'). Therefore, the shape of biliteral verbs can also be considered a default prosodification of the root consonants and theme vowels.

I follow Tucker's intuition that the shape of the Basic verbal form comes from phonological constraint interaction, rather than any morphological specification of word-shape. The driving constraints for the default prosodic structure are avoidance of complex clusters and requirement of onsets, both of which are active in the general phonology of the dialects:

(8) *COMPLEX: assign a violation mark for a tautosyllabic sequence of two or more consonants (Prince and Smolensky 1993)

(9) ONSET: assign a violation mark for a syllable without a onset (Ito 1989, Prince and Smolensky 1993)

These constraints must dominate the preference to have contiguous morphemes:

(10) CONTIGUITY$_{morph}$: assign a violation for every sequence of two segments of a morpheme in the input which are not contiguous in the output (McCarthy and Prince 1990, Tucker 2010)

One final constraint is needed to ensure that all stems in Arabic end in consonants (McCarthy and Prince 1990). Tucker (2010) uses a constraint that favors alignment of the root to the left and right side of the prosodic word, but it's also possible to use McCarthy (2005)'s simpler constraint:

(11) FINAL-C$_{stem}$: assign a violation for a stem-final vowel

Using these constraints, a sample derivation of a triliteral verb would look as follows:

(12) The Basic verbal form in Arabic

	a,a$_{Th}$-lʕb$_{\surd}$	*COMPLEX	ONSET	FINAL-C	CONTIGUITY$_{morph}$
☞	la.ʕab				**
	laʕ.ba			*W	*L
	al.ʕab		*W		*L
	lʕa.ba	*W		*W	*L

*COMPLEX, ONSET, FINAL-C ≫ CONTIGUITY

For more details of this kind of analysis, see Tucker (2010) or Ussishkin (2003).[2]

2.4.2 The Basic Form in Akkadian

Parallel to the basic verbal form in Arabic (Form I), the morphosyntactically unmarked verbal form in Akkadian is known as the G-stem, and takes the form i-C$_1$C$_2$VC$_3$ in the perfective tense/aspect (which is also morphologically unmarked). The /i-/ is the 3rd masculine agreement prefix and the identity of the vowel depends on the conjugational class of the verb.

(13) 3ms perfective verbs in Akkadian

Root	Basic Form	
prs	i-prus	'he divided'
mqt	i-mqut	'he arrived'
ʃrq	i-ʃriq	'he stole'

As is further discussed in Section 4, if Akkadian had the same prosodification of the root as Arabic (for example /parus/, the addition of the agreement prefix would create a sequence of three light syllables *[i.pa.rus], which is ill-formed in the language. On the other hand, in the perfect tense/aspect, the additional /-t-/ infix means that this syllabic configuration would not arise, and in these forms, a vowel does surface between the second and third root consonant:

(14) 3ms perfect verbs in Akkadian

Root	Basic Form	
prs	ip.ta.rus	'he divided'
mqt	im.ta.qut	'he arrived'
ʃrq	iʃ.ta.riq	'he stole'

For more discussion on this subject, see Section 4. I conclude that, like in Arabic, the basic verbal form in Akkadian is also the default syllabification and prosodification of the root consonants and theme vowels.

Akkadian, like Arabic, also has verbs with four consonants in the stem, but it seems that these are not true quadriliteral verbs, as will be discussed further in Section 6.2. These verbs do not appear in the basic form, but only in combination with a derivational prefix (either the causative prefix /ʃ(a)-/ or the passive prefix /n-/). For example, the root $\surd$BLKT appears in the causative as [uʃbalkit] 'he rebelled'.

There are no obviously biliteral roots in Akkadian. Although there are several roots where the second and third consonant of the root are identical (for example $\surd$DNN as in [dana:num] 'to grow strong), since these behave like triliteral roots morphologically and phonologically, there is no motivation to consider them biliterals in the same sense as for Arabic.

[2]The so-called hollow or weak roots involve more complex phonology that requires additional analysis and will not be discussed in this paper.

3 Lengthening and Gemination as Targeted Morphological Infixation

The basic form in both languages can be analyzed as concatenative – e.g., /fʕl, a-a/ –> [faʕal] (see also Section 6). But something more needs to be said about the verbal forms in Arabic and Akkadian in which a morpheme is expressed by lengthening. Since the result of morpheme realization in these forms is prosodic rather than segmental, it serves as an important case study of the interaction of morphological realization and the phonological grammar. I argue that lengthening is best understood as moraic infixation, whose position is determined by the identity of the morpheme itself rather than by considerations of phonological markedness or prosodic structure (contra Ussishkin 2003 and Tucker 2010).

3.1 Forms in Arabic with Morphophonological Lengthening

Three different verbal forms in Arabic are derived by lengthening: the causative (Form II), applicative (Form III) and the inchoative (Form IX). In each case the lengthening is the only exponent of the morpheme and the location of the lengthening is consistent, but specific to each form. Since lengthening occurs in three different positions determined solely by morphosyntactic context, both the lengthening and its position must be a property of the morpheme rather than of specific lexical items or the general phonology of the language. These data are reviewed below and analyzed in Section 3.3.

The causative Form II is associated with a causative feature on the little ν head (Al-Kaabi 2011, Erwin 2004, Qafisheh 1977) and is characterized by gemination of the middle radical resulting in the shape $C_1VC_2C_2VC_3$ for both biliteral and triliteral verbs.

(15) a. Triliteral verbs in Gulf Arabic

Basic (I)		Causative (II)	
ʕaraf	'he came to know'	ʕarraf	'he made s.o. acquainted with sth.'
daras	'he studied'	darras	'he taught'
xalʕasʕ	'it finished'	xalʕlʕasʕ	'he finished sth.'

b. Triliteral verbs in Iraqi Arabic

Basic (I)		Causative (II)	
tiʕab	'he got tired'	taʕʕab	'he tired s.o.'
libas	'he put sth. on'	labbas	'he dressed s.o.'
diras	'he studied'	darras	'he taught'

c. Biliteral forms in Iraqi Arabic

Basic (I)		Causative (II)	
tamm	'is complete'	tammam	'he completed'
(no basic form)		qarrar	'he decided'

Quadriliteral verbs do not occur in this form (for an analysis of this fact based on stem maximality, see Section 6.2).

Form III is often described as having a reciprocal or associative meaning, and is argued by Al-Kaabi (2011) to be associated with an applicative little ν head. It is characterized by lengthening of the first vowel within the stem resulting in the shape $C_1VVC_2VC_3$ for both biliteral and triliteral verbs:

(16) a. Triliteral verbs in Gulf Arabic

Root	Applicative (III)	
xbr	xaabar	'he telephoned'
xsʕm	xaasʕam	'he quarreled with s.o.'
brk	baarak	'he blessed'

b. Triliteral verbs in Iraqi Arabic

Basic (I)		Applicative (III)	
tʕilab (ʃii) min	'he requested (sth) from	tʕaalab	'he demanded of, claimed fr.'
ʕimal (ʃii) b-	'he did (sth) to'	ʕaamal	'he treated (e.g. well)'

c. Biliteral verbs in Iraqi Arabic

Root	Applicative (III)	
zɕʒ	zaaɕʒaɕʒ	'he argued with'

Once again, quadriliteral roots do not occur in this form (see Section 6.2).

The last verbal form in Arabic with morphophonological lengthening, Form IX, is less frequently discussed since it is unproductive in most dialects. However, Al-Kaabi (2011) argues that it is quite productive in Emirati-Gulf Arabic, where it corresponds to an inchoative little ν head. This form has gemination of the final radical of the root resulting in the shape C1C2VC3C3 for triliterals.

(17) a. Triliteral verbs in Emirati Gulf Arabic (Al-Kaabi 2011)

Root	Inchoative (IX)	
mtn	mtann	'he became fat'
xðˤr	xðˤarr	'it became green'

b. Triliteral verbs in General Gulf Arabic (Qafisheh 1977)

Root	Inchoative (IX)	
ʕwj	ʕwajj	'it turned crooked, twisted'
xðˤr	xðˤarr	'it turned green'

c. Triliteral verbs in Iraqi Arabic (Erwin 2004)

Root	Inchoative (IX)	
tˤ rʃ	tˤ raʃʃ	'he grew deaf'
xðˤr	xðˤarr	'it turned green'

Quadriliterals do occur in this form with the shape $C_1C_2VC_3VC_4C_4$:

(18) Quadriliteral verbs in Iraqi Arabic

Root	Inchoative (IX)	
ʃmʔz	ʃmaʔazz	'he was disgusted, revolted'
qʃʕr	qʃaʕarr	'he felt a chill, shuddered'
tˤmʔn	tˤma ʔann	'he felt reassured'

Neither Qafisheh (1977), Erwin (2004), nor Al-Kaabi (2011) cite any examples of biliterals in this form.

Arabic verbs can show lengthening in three different locations, with the difference solely determined by a difference in morphosyntactic features, and no phonological differences in the input. This shows that the lengthening in these verbal forms is conditioned by the morphosyntactic environment, not by general phonological processes of the languages.

3.2 Forms in Akkadian with Morphophonological Lengthening

Akkadian has two forms of the verb which are distinguished by morphological lengthening processes, the intensive and the imperfective both have a geminated middle radical of the root. This is an interesting complement to the Arabic data since two different morphemes in the same language condition exactly the same morphophonological process of gemination, but they cannot both apply at once, and they interact differently with other phonological processes in the language (as will be discussed in Section 4).

The form traditionally known as the D-stem, which I have been calling the intensive, has gemination of the middle radical similar to the Arabic causative (Form II). The vowel of the agreement prefix also changes between the basic and the intensive:

(19) 3ms perfective causative verbs in Akkadian

Basic Form		Intensive	
i-dmiq	'he was good'	u-dammiq	'he made (sth.) good'
i-xliq	'he perished'	u-xalliq	'he destroyed'
i-priʃ	'he became wide'	u-parriʃ	'he widened'

Gemination of the middle radical is also used to mark imperfective tense/aspect (traditionally known as the durative), which takes the form i-C_1aC_2C_2VC_3. The theme vowels also change between the two aspects, but this is part of an independent allomorphic process, discussed in Section 5:

(20) 3ms Basic verbs in Akkadian:

Root	Perfective	Imperfective	
prs	i-prus	i-parras	'he divided/divides'
sʔbt	i-sʔbat	i-sʔabbat	'he seized/seizes'
ʃrq	i-ʃriq	i-ʃarriq	'he stole/steals'

Verbs that are marked for both intensive and imperfective show gemination of the middle radical only once:

(21) 3ms intensive verbs in Akkadian

Root	Perfective	Imperfective	
dmq	u-dammiq	u-dammaq	'he made/makes (sth.) good'
xlq	u-xalliq	u-xallaq	'he destroyed/destroys'
prʃ	u-parriʃ	u-parraʃ	'he widened/widens'

Even when segmental infixation provides more potential targets for gemination, only the middle consonant of the root is ever geminated: the imperfective with the addition of the iterative /-tan-/ infix becomes [iptanarras], not *[ippatanras], *[ipattanras], or *[iptannaras].

3.3 Analysis

Lengthening in these languages, whether it be gemination of the middle or final radical of the root, or lengthening of the first vowel, serves as the surface realization of a particular morpheme, in the same way that a prefix or suffix does. I argue that the exponent of the morpheme that causes lengthening is an autosegment (such as a mora), which infixes into the stem in a particular location and then is associated by the phonology to a segment of the stem, causing it to surface as long.[3]

The key observation is that the location of lengthening is specific to the particular morpheme. For example, the causative in Arabic always has lengthening on the second radical of the root and nowhere else. The inchoative, on the other hand, shows lengthening only on the final radical of the root, and the applicative only on the first vowel of the stem. In Akkadian, on the other hand, two different morphemes cause lengthening in the exact same position, no matter what the phonological shape of the verb.

Considering the evidence from both languages together, it cannot be the case that the autosegmental morpheme, being phonologically defective, is simply associated to the least marked place in the available structure (here the verb stem). If the mora were positioned by the phonology, then we might expect it to dock elsewhere when its preferred position is not available, however this never occurs. In intensive imperfective verbs there should be two morae in the input, but only one ever surfaces. Assuming an input like /u-μ-μ-damaq/, we might expect an output like *[uddammaq] where the first mora docks in the preferred location, forcing the second one to dock in the next best location, which is still unmarked from the point of view of the phonotactics of the language (c.f. [ipparras] from /i-μ-n-paras/). Instead, the second mora deletes if it cannot dock on the middle radical. While lengthening may be blocked in certain cases (see also Section 4), it never moves to another location. This is true of all the forms with morphological lengthening within the verbal system of both languages.

Therefore, lengthening behaves as if it is controlled morphologically not phonologically. The location of lengthening is determined like immobile infixation in being an arbitrary property of the morpheme. Yu (2003, 2007) studies many such cases of infixation cross-linguistically, arguing for a Phonological Subcategorization approach to infixation, where infixes are understood as morphemes that can specify a phonological entity to which they align.

3.3.1 Morpheme-Specific Positioning Constraints for Arabic

Since the location of infixation is determined by the specific morpheme, the operation that positions the mora must be able to reference both the morphosyntactic identity of that mora and the phonological structure of the representation into which it infixes. This is exactly the nature of a lexically-indexed constraint (Flack 2007, Gouskova 2007), therefore I will use inviolable (or at least undominated) morpheme alignment constraints, following Yu. These constraints can pick out a phonological constituent (segment, syllable or foot) at either the left or right edge of the prosodic word and place the infix before or after this constituent. Thus, only edge-oriented infixation that respects phonological constituent-hood can be described by these constraints.

[3]For arguments in favor of autosegmental morpheme realizations, see Wolf (2007).

The Arabic causative form with gemination of the middle radical (e.g. [darras]) can be derived by infixing the mora directly before the final syllable. The constraint definition below is based on the schema from Yu (2003):

(22) Align(R-μ_{caus}, L-$\sigma]_{Pwd}$): Align the realization of the causative morpheme to the left of the final syllable of the prosodic word

I assume that the mora is added to an already prosodified form with theme vowels present for reasons discussed in Section 3.3.2. In any case, whether the constraint references input or output syllabification, it will cause the mora to infix directly before the final syllable:

(23) μ_{caus} + da.ras → da-μ-.ras → dar.ras

Since the mora cannot be realized on its own, it needs to dock onto a segment. In order to geminate the middle radical, the mora must associate to the segment to its right as shown above. I will assume here that autosegmental association always proceeds right to left, following work in autosegmental phonology (Goldsmith 1979, McCarthy 1981).[4]

The Arabic applicative form with lengthening of the first vowel (e.g. [xaabar]) can be derived by infixing the mora directly after the first consonant of the word:

(24) Align(L-μ_{appl}, R-$_{Pwd}$[C: Align the realization of the applicative morpheme to the right of the first segment of the prosodic word

If the mora again associates to the segment to its right, it will lengthen the first vowel:

(25) μ_{appl}+ xabar → x-μ-a.bar → xaa.bar

The Arabic inchoative form with gemination of the final radical (e.g. [mtann]) is derived by infixing the mora directly before the final consonant of the word:

(26) Align(R-μ_{inchoa}, L-C]$_{Pwd}$): Align the realization of the inchoative morpheme to the left of the final segment in the prosodic word

This time leftward association lengthens the final consonant:

(27) μ_{inchoa} + matan → ma.ta-μ-n → mtann (with vowel deletion, see Section 6.1)

All three of these are attested positions for segmental infixation cross-linguistically (Yu 2003). The analysis of Akkadian gemination is essentially identical to the Arabic causative, and therefore the details will be omitted here.

3.3.2 Biliteral Verbs in Arabic

In order for this analysis to work for biliterals in Arabic, a few more details must be spelled out. The mora must be added to an already prosodified form. If the applicative mora is aligned to the right edge of the final segment of the word simultaneously with prosodification, the following incorrect derivation would result:

(28) μ_{appl} + zaʤ→ z-μ-aʤ→ *[(zaa)ʤ] (desired result [(zaa)ʤaʤ]

If the mora is instead added to an already footed form where a minimal prosodic word requirement has already geminated the final consonant (see Section 2.4.1), the addition of the mora leads to a super-heavy syllable:

(29) μ_{appl} + (zaʤ)ʤ→ (z-μ-aʤ)ʤ→ *[(zaa)ʤʤ]

[4]This assumption is not necessary. It could also be the case that the causative mora prefers to associate to a consonant and the applicative mora prefers to associate to a vowel.

As discussed further in Section 6.2 there is evidence that super-heavy syllables are not allowed in verbal stems in these dialects of Arabic. Under a hybrid representation of geminates where they are a consonant linked to two timing slots the first of which is associated with a mora (Davis 2011), in certain circumstances geminates are expected to behave like a consonant cluster. I suggest that in this case, epenthesis between the two timing slots of the geminate will cause re-syllabification and avoid the marked structure of a super-heavy syllable. This requires the following constraint:

(30) *$\sigma_{\mu\mu\mu}$: Assign a violation for a tri-moraic syllable (Zec 1995)

Only considering candidates where the mora has been correctly aligned to lengthen the first vowel, avoidance of the superheavy syllable results in epenthesis:

(31)

	μ_{appl}+(zaʤ)ʤ	*$\sigma_{\mu\mu\mu}$	IDENT-μ	DEP
☞	(za[μ]a) ʤaʤ		**	*
	(za[μ]aʤ)ʤ	*W	*L	L

*$\sigma_{\mu\mu\mu}$ ≫ IDENT-μ, DEP

In the winner, the vowel epenthesis incurs a DEP violation and causes the moraicity of the /ʤ/ to be lost, but these violations are preferred to having a super-heavy syllable (or failing to realize the applicative mora).

In the causative, on the other hand, the alignment of the mora causes a different problem. Starting again from the syllabified form, the mora is aligned to the right edge of the first syllable:

(32) μ_{caus} + (tam)m → (tam)-μ-m

The mora cannot associate to the segment to its right (e.g. [(tamm)] because the final consonant cannot be moraic in Arabic. Association to its left (if possible) would create a bimoraic, or extra-long consonant (e.g. [(tamm)m], which presumably is forbidden. I suggest that the attested form [(tam)mam] should be seen as a repair to this impasse. It is not clear that any analysis since CV-skeletons can solve this problem more elegantly.

3.4 Conclusion

This section has argued that since lengthening in these languages always correlates with specific morphemes, it should be understood as the exponent of those morphemes. Specifically, I analyze the content of the morphemes themselves as a moraic autosegment, which infixes into the verb stem. I argued that the position of infixation must be determined by the identity of the morpheme, rather than being governed by phonological markedness constraints (contra Ussishkin (2003)). Lengthening in these languages, then, is formally the same as immobile segmental infixation and is determined morphologically not phonologically.

4 The Interaction of Gemination and Syncope in Akkadian

As I already alluded to in Section 3, the two forms in Akkadian with morphophonological gemination interact differently with the regular process of syncope in the language. In this section, I argue that this difference is cyclic in nature, following from a difference in where the two morphemes are positioned in the syntactic structure. This kind of interaction of morphological and phonological processes cannot be captured in a theory where morphophonological lengthening is controlled by the phonological grammar, as is demonstrated in Section 4.3. First I will analyze the process of syncope and show how it applies to verbal stems.

4.1 Akkadian Syllable Structure and Syncope

As a long dead language, what we know about Akkadian phonology comes from its writing system, which was mainly syllabic with signs based on both consonants and vowels. No Akkadian dialect had tautosyllabic consonant clusters, and all used productive synchronic epenthesis both within and across morpheme boundaries to break up such clusters. There was also a process of syncope where in a sequence of three light syllables, the middle vowel deleted. Closed syllables and syllables with long vowels count as heavy, with the exception of final syllables, where the last consonant does not count towards weight, and thus can be analyzed as an appendix to the prosodic word level (Rosenthall and Van der Hulst 1999). The examples of syncope below are from Greenstein (1984) and McCarthy (1993):

(33) Akkadian syncope in nominal and verbal forms

Underlying form	Surface form with syncope	Gloss
/ʃakin-um/ (c.f. [ʃakin])	[ʃaknum]	‘placed (nominative participle)’
/ʃubat-um/ (c.f. [ʃubat]	[ʃubtum]	‘seat (nominative)’
/eniʃ-at/ (c.f. [eniʃ]	[enʃat]	‘weak feminine)’
/damiq-at/ (c.f. damiq)	[damqat]	‘good (feminine)’
/i-ptaras-u/ (c.f. [iptaras]	[iptarsu]	‘has decided (3rd pl)’

All examples of syncope create a heavy penultimate syllable. Although we know very little about Akkadian stress, Greenstein (1984) reviews the metrical evidence, concluding that stress fell by rule on the last heavy syllable of the word (again, assuming that the final consonant does not count towards weight). This suggests that syncope serves to satisfy Stress-to-Weight (SWP: stressed syllables must be heavy, Prince 1990), creating a stressed heavy penultimate syllable whenever it is possible to do so without creating a consonant cluster.

(34) Akkadian syncope in feminine adjectives

	/damiq-at/	*COMPLEX	SWP	MAX
☞	(dám.qa)t			*
	da.(mí.qa)t		*W	L
	/damiq/			
☞	(dá.mi)q		*	
	(dám)q	*W	L	*W

*COMPLEX ≫ SWP ≫ MAX

For the first input, the medial vowel syncopates so that the stressed syllable will be heavy. In the second input, however, syncope is not possible since it would create a complex cluster, and thus stress is tolerated on a light syllable.

4.1.1 Syncope in Verbal Stems

Although the basic verbal form in the perfective aspect has no vowel between the second and third consonants of the root (e.g. i-s$^{?}$bat), I suggest that the underlying form of the verb stem has a vowel here, but that the addition of an agreement prefix (which are always vowel final: compare [aprus] ‘I decided’, [iprusu] ‘they decided’, [niprus] ‘we decided’) conditions syncope. This underlying vowel surfaces when additional prefixes or infixes cause another consonant to syllabify with the agreement prefix so that it no longer creates an environment for syncope.

The same ranking posited for syncope elsewhere in the language applies without modification to generate the correct outputs for the basic verbal form and the passive in the perfective aspect. In the tableau below, I have also included a constraint CODACOND, to drive the full assimilation of the coda nasal in iddamiq, which is a regular phonological process throughout the language (the underlying form of the passive prefix can be seen in forms where the nasal is followed by a vowel such as the infinitive *naprusum* ‘to be decided’):

(35) Akkadian 3ms perfective basic and passive verbs

	/i$_{3ms}$-damiq/	CODACOND	*COMPLEX	SWP	ALL-FT-R	Max
☞	(íd.mi)q					*
	i.(dá.mi)q			*W		*
	/i$_{3ms}$-n$_{pass}$-damiq/					
☞	(íd.da).miq				*	
	id.(dám)q		*W		L	*W
	id.(dá.mi)q			*W	L	
	(ín.da).miq	*W			*	

COMPLEX ≫ SWP ≫ ALL-FT-R

Syncope occurs in the basic form to avoid stressing a light syllable, while in the passive, the prefix /n/ makes the first syllable heavy, and no syncope occurs.

4.2 Gemination Blocking

Phonological syncope and morphological gemination each have the potential to block the other, since gemination closes the penultimate (stressed) syllable of the word, removing a context for syncope, while syncope creates a cluster which if targeted for gemination would create a complex margin. As it turns out, the intensive and imperfective morphemes interact differently with syncope, showing that morphological gemination is independent of prosodic constraints.

The intensive morpheme, like the passive prefix shown above, removes the context for syncope by creating a penultimate heavy syllable:

(36) /u-μ-damiq/ $\rightarrow$ [u.(dám.mi)q], *[udmiq]

There are no intensive forms which do not have a geminated second radical.

On the other hand, there are several imperfective forms where gemination does not occur. For example, the imperfective of a verb from the root $\sqrt{}$PRS with a causative /ʃa-/ prefix is [uʃapras], not *[uʃaparras] as expected:

(37) /u-μ-ʃa-paras/ $\rightarrow$ [u.(ʃáp.ra)s], *[uʃaparras]

The key observations are that the causative prefix is vowel-final and also morphosyntactically closer to the root than a tense/aspect morpheme like the imperfective. Therefore, if the causative prefix is realized first and conditions syncope before the mora is positioned, association of the imperfective mora would create an illegal syllable structure.

This analysis depends on a cyclic interaction of morphology and phonology. There are several different ways to implement such an analysis including a stratal framework (Kiparsky 2000, Bermudez-Otero 2008) (although there is no need to re-rank constraints between levels) or Optimal Interleaving (Wolf 2008) without any interaction between morphological and phonological constraints. For my purposes, it is enough that the phonological grammar applies once after the derivational stem is formed by the combination of the little ν morpheme with the root, and once at the word level after the inflectional tense and agreement morphemes have been added to the verb. In this case, the combination of the causative prefix with the root conditions syncope at the stem level, so that the word-level tense/aspect affixation cannot apply:

(38) Syncope at stem level in Akkadian causative

	/ʃa$_{caus}$-paras/	AL(L-μ_{imp}, R-σ]$_{Pwd}$)	*COMP	DEP	SWP	ALL-FT-R	MAX
☞	(ʃáp.ra)s						*
	ʃa.(pá.ra)s				*W		L

At this point there is no moraic morpheme in the derivation. The phonologized stem is then combined with aspect and agreement morphemes and sent back to the phonological grammar. The newly introduced mora of the imperfective morpheme is now subject to its positioning constraint, but cannot be infixed into the correct position without either creating a complex syllable margin (candidate 39c.) or epenthesizing a vowel (candidate 39d.). A high-ranked *COMPLEX and DEP prevent either of these options so that the moraic infix is deleted instead and no gemination occurs. In the tableaux below, the positioning of the moraic infix is shown in square brackets when present:

(39) Gemination blocking at word level in imperfective of Akkadian causative

	/u$_{3ms}$-μ_{imp}-ʃapras/	AL(L-μ_{imp}, R-σ]$_{Pwd}$)	*COMP	DEP	SWP	ALL-FT-R	MAX
☞	u.(ʃáp.ra)s						*
b.	uʃ[μ].(ʃáp.ra)s	*W					L
c.	u.(ʃápr[μ].ra)s		*W				L
d.	u.ʃa.(pár[μ].ra)s			*W			L

ALIGN(L-μ_{imp}, R-σ]$_{Pwd}$), *COMPLEX, DEP $\gg$ MAX

Thus syncope conditioned by a stem-level affix blocks gemination conditioned by a word-level affix.

On the other hand, since the intensive affix combines directly with the root, and is therefore a stem-level process, gemination occurs before syncope could be conditioned by the word-level agreement affix:

(40) Gemination at stem-level in Akkadian intensive

	/μ_{intens}-paris/	AL(L-μ_{imp}, R-σ]$_{Pwd}$)	*COMP	DEP	SWP	ALL-FT-R	MAX
☞	(pár[μ].ri)s						
b.	(pá.ri)s				*W		*W
c.	pa.(rís)s	*W					
d.	(p[μ]pri)s		*W				*W

(41) No syncope at word-level in Akkadian intensive

	/u$_{3ms}$-$\emptyset_{perf}$-parris/	AL(L-μ_{imp}, R-σ]$_{Pwd}$)	*COMP	DEP	SWP	ALL-FT-R	MAX
☞	u.(pár.ri)s						
b.	(úp.ri)s						**W
c.	(úpr.ri)s		*W				*W

In this case, syncope is never conditioned, and so gemination is never blocked.

The only other affix besides agreement morphemes and the causative /ʃa-/ prefix which conditions syncope is the iterative infix /-tan-/, which, like the causative also blocks gemination in the imperfective. This fits with my analysis since iterative should attach to the verb before tense/aspect and thus should condition syncope before the imperfective morpheme is realized.

This analysis derives when gemination does and does not occur in Akkadian from a cyclic account that appeals only to the normal phonology of the language and the different morphosyntactic positions of the intensive and the imperfective morphemes, both of which are independently needed. Below, I will contrast my concatenative analysis with approaches which rely on phonological templates.

4.3 Alternative Analyses

Tucker (2010) in his analysis of Iraqi Arabic derives morphophonological lengthening from a phonological template which emerges from the interaction of morpheme-specific prosodic constraints evaluated over the whole word. He derives the basic form of verbs from a default prosodification of the root and theme vowels mediated by markedness constraints against complex clusters.

Lengthening happens in the causative and applicative of Arabic verbs due to an additional constraint NONFINALITY-FT, which is lexically indexed to both a null causative and applicative morpheme. Since degenerate feet are not allowed in Arabic, this causes the first syllable to lengthen so that it can be footed on its own without inclusion of the final syllable:

(42) Tucker's analysis of Arabic Form III (applicative) with triliteral roots

	/fʕl$_{\surd}$/, /a/, $\emptyset_{III}$	NONFIN-FT$_{II,III}$	*GEM	NOLONGV	DEP-μ
☞	(faa)ʕal			*	*
	(faʕ)ʕal		*W	L	*
	(faʕal)	*W		L	L

The difference between the Arabic causative and applicative is then derived with an additional constraint against long vowels, which is indexed only to the null causative morpheme:

(43) Tucker's analysis of Arabic Form II (causative) with triliteral roots

	/fʕl$_{\surd}$/,/a/,$\emptyset_{II}$	NONFIN-FT$_{II,III}$	NOLONGV$_{II}$	*GEM	DEP-μ
☞	(faʕ)ʕal			*	*
	(faa)ʕal		*W	L	*
	(faʕal)	*W		L	L

This type of approach faces difficulty with the Akkadian data. If gemination happens for a prosodic reason in Akkadian, then in a particular morphological context, the language should always choose either gemination or syncope. The analysis would be that gemination in Akkadian happens for the same reason as syncope, namely to produce a heavy penultimate syllable. For example, in forms containing the intensive morpheme, gemination is preferred to syncope, due to a MAXV constraint lexically indexed to this morpheme:

(44) Hypothetical analysis of the Akkadian intensive 3rd ms perfective

/u-$\emptyset_{intens}$-paris/	SWP	MAXV$_{intens}$	*GEM
☞ u.pár.ris			*
úp.ris		*W	L
u.pá.ris	*W		L

SWP, MAXV$_{intens}$ $\gg$ *GEM

But in the imperfective, sometimes syncope applies and sometimes gemination does: gemination only occurs when syncope is NOT conditioned. In order for gemination to occur instead of syncope in the imperfective of the basic form, the same ranking of constraints is needed as for the intensive. On the other hand, for syncope to occur in the imperfective of the causative, the exact opposite ranking is needed, leading to a paradox:

(45) Paradoxical ranking between the Akkadian basic imperfective and causative imperfective verbs

/i-$\emptyset_{imp}$-paras/	SWP	MAXV$_{imp}$	*GEM
☞ i.pár.ras			*
íp.ras		*W	L
i.pár.ras	*W		L
/u-$\emptyset_{imp}$-ʃa$_{caus}$-paras/			
☞ u.ʃáp.pras		*	
u.ʃa.pár.ras		L	W
u.ʃa.pá.ras	*W	L	

This paradox shows that syncope and gemination cannot be conitioned by the same prosodic constraint; however since gemination does not improve the markedness of a form except by creating a closed syllable, it is not clear what kind of prosodic constraints would ever be a conditioning environment for gemination but not for syncope.[5]

An even more highly templatic analysis than Tucker's might hypothesize that the syllabic shape of stems is stored such that the shape of the intensive in Akkadian is specified in the lexicon as ʃaC$_1$C$_2$VC$_3$ (e.g. [ʃapras]) for all tense/aspects, while that of the intensive is C$_1$VC$_2$C$_2$VC$_3$ (e.g. [parras]). In the Akkadian basic stem, different syllabic shapes would have to be stored for different tense/aspects so that the perfective is C$_1$C$_2$VC$_3$ (e.g. [prus]), while the imperfective is C$_1$VC$_2$C$_2$VC$_3$ (e.g. [parras]). This account misses the connection between gemination blocking and a regular process of syncope in the language.

4.4 Conclusion

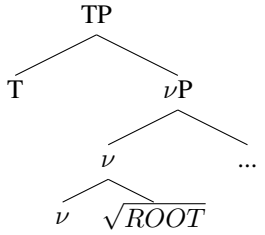
In this section I have argued that the interaction of gemination and syncope in Akkadian is a cyclic interaction of morpheme realization and phonological processes that shows sensitivity to a concatenation of morphemes deriving from the morphosyntactic structure of the verb. A consequence of this concatenative approach is that we expect morphophonological processes to show the same morphological locality effects that have been well-studied for affixal morphology. In the next section, I will show that lengthening behaves as if it is concatenated for the purpose of determining morphological locality in allomorphy selection.

5 Theme Vowel Allomorphy

It has been well established in the Distributed Morphology literature that certain allomorphy relationships depend on phonological adjacency. For example, Marantz (2013) argues that root-specific past tense forms in English depend on the phonological adjacency of the tense morpheme and the root. The structure below shows the spell-out domain:

[5]This paradox could be avoided by associating the causative morpheme with its own lexically-indexed prosodic constraint favoring syncope that outranks the lexically-indexed constraint of the imperfective favoring gemination. This makes syncope sometimes a phonological process and sometimes a morphophonological process, and also concedes the point that lengthening must sometimes be morphological.

(46)



When the little ν is both a default and null, nothing is inserted by the morphology causing the past tense and $\sqrt{}$TEACH to be adjacent under concatenation, allowing an irregular past tense form. Examples are from Marantz (2013):

(47) T_{pst}+$\nu(\emptyset)$+$\sqrt{}$TEACH $\rightarrow$ taught

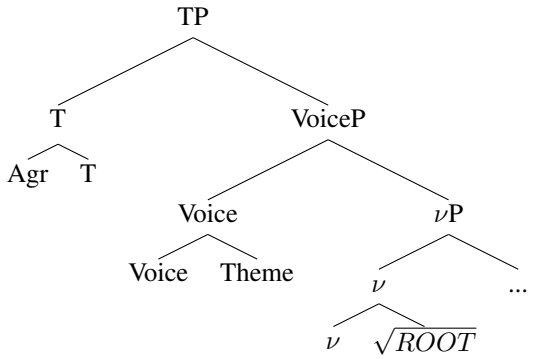
There are never irregular past tense forms for verbs with an overt little ν:

(48) T_{pst}+ν(ize)+$\sqrt{}$QUANTUM $\rightarrow$ quantized, *quintized, *quantumized, etc.

No verbs formed with /-ize/ or any other overt little ν affix ever show stem allomorphy conditioned by tense. This is not just regularity, but a predictable distribution of regularity.

Stem vowel allomorphy in Akkadian and Arabic shows a similar kind of regularity. While the verbal stem vowel system differs between Akkadian and Arabic, as well as within different dialects of Arabic, the allomorphy conditioning factors are essentially identical. The selection of stem vowel must be sensitive at least to the aspectual features of a verb, as well as to the phonology and idiosyncratic class of the root. When there is an overt realization of little ν (such as intensive gemination), however, the identity of the root can no longer influence the selection of the vowel pattern. I analyze this as blocking of an allomorphy relationship between the theme vowels and the root by the intervening phonological material of overt little ν morphemes. Importantly, nonconcatenative morpheme realizations behave the same as an affix in counting as an overt intervener. This analysis is based on the following syntactic structure which I will argue for in Section 5.4:

(49)



The analysis depends on a concatenative, piece-based account of Semitic morphology to capture the observed regularity.

5.1 Akkadian Theme Vowels

In the unmarked verbal form in Akkadian (where there is no overt realization of little ν), the vowel between the second and third consonant of the stem is determined by the identity of the root. These vowels do not have any morphosyntactic function, but can vary depending on the aspect of the verb, making them formally similar to theme vowels in many other languages, including Romance (Oltra Massuet (1999), Harris (1991), etc.). There are four possible vowel classes with the patterns shown below for representative verbs:

(50) Akkadian theme vowel classes in the Basic form

Class	Imperfective	Perfect	Perfective	Gloss
a-u	i-parr̲a̲s	i-pta̲ra̲s	i-pru̲s	'to divide, separate out'
a	i-sʔabba̲t	i-sʔsʔabba̲t	i-sʔba̲t	'to seize, capture'
i	i-ʃarr̲iq	i-ʃtar̲iq	i-ʃr̲iq	'to steal'
u	i-maqqu̲t	i-mtaqu̲t	i-mqu̲t	'to fall, collapse'

Judging from an informal survey, all four vowel classes are robustly attested in the Old Babylonian dialect of Akkadian. Since the "a-u" class patterns with the "a" class in the imperfective and perfect, but with the "u" class in the perfective, it is not possible to predict the form of one aspect from another. In order to know the theme vowel for a verb in a particular aspect, it is necessary to know what class the verb belongs to.

In the passive stem, these four possible vowel classes are reduced to two:

(51) Akkadian theme vowel classes in the passive (note full assimilation of the passive nasal prefix)

Class	Imperfective	Perfect	Perfective
a-u, a, u	i-pparra̲s	i-ttapra̲s	i-ppar̲is
i	i-ʃʃarr̲iq	i-ttaʃr̲iq	i-ʃʃar̲iq

The "i" class retains the same theme vowel as it had in the basic verbal stem, while the "a-u", "a", and "u" vowel classes now all share a new pattern of vowels. To capture these facts, the allomorphy of the theme vowel must be simultaneously sensitive to the syntactic features on voice and aspect as well as the identity of the root.

On the other hand, when there is an overt realization of features on little ν (i.e. either gemination in the intensive or the addition of the /ʃa-/ prefix in the causative), all verbs pattern together, and the theme vowels only vary according to aspect:

(52) Akkadian intensive verbs

Class	Imperfective	Perfect	Perfective
a-u, a, u, i	u-parra̲s	u-ptarr̲is	u-parr̲is

(53) Akkadian causative verbs

Class	Imperfective	Perfect	Perfective
a-u, a, u, i	u-ʃa-pra̲s	u-ʃ-tapr̲is	u-ʃa-pr̲is

The perfect aspect patterns with the perfective aspect, as opposed to the imperfective as it did before, indicating that there is a three way distinction in aspect-conditioned allomorphy. On the other hand, the vowels patterns for both the intensive and causative forms are the same, indicating that this is not allomorphy conditioned by a specific feature on little ν, but rather resort to less-specified allomorphs of the theme vowels.

The reciprocal infix -t- and the iterative infix -tan- can combine with any of the stems discussed above, but do not affect the quality of the theme vowel.

5.2 Gulf Arabic Theme Vowels

Theme vowel allomorphy in Gulf Arabic follows the same basic pattern as Akkadian, with multiple different root-conditioned classes when there is no overt realization of little ν, but no root-specific patterning in the causative, applicative and inchoative which have overt realizations of little ν.

According to the description by Qafisheh (1977), verbs in Gulf Arabic can show one of three possible vowel patterns in the perfective aspect of the basic form (no overt realization of little ν):

(54) a. a-a vowel pattern
laʕab 'he played', baraz 'he was ready', tafal 'he spat', ʃarad 'he ran away'

b. i-a vowel pattern
tirak 'he left', ʕibar 'he crossed', tiras 'he filled', fitaħ 'he opened'

c. i-i vowel pattern
simiʕ 'he heard', ʕirif 'he knew', ʃirib 'he drank', rijiʕ 'he returned'

While the vowel pattern is determined by the root, he describes quite a bit a variability in the class membership of roots especially between different speakers, citing both laʕab and liʕab for 'he played', and noting that the i-i pattern was unstable in most dialects and was often replaced by a different vowel pattern (for example wisʕal for wisʕil 'he arrived').[6] This is also true of other dialects (Gouskova and Hall 2009, Haddad 1984) and is not unexpected since it is normal for there to be some slippage between different root-conditioned allomorphs (compare, for example, the English irregular past tenses).

As in Akkadian, these root-specific vowel patterns also depend on the aspect of the verb. The possible combinations of perfective and imperfective forms for basic verbs are given below with representative verbs:

(55) Gulf Arabic theme vowel classes

Class	Perfective	Imperfective	Gloss
i-a to i	diras	jadris	'to study'
i-a to a	difaʕ	jidfaʕ/jadfaʕ	'to pay'
a-a to i	baraz	jabriz	'be ready'
i-i to a	ʃirib	jiʃrab/jaʃrab	'to drink'

Since the verbs with i-a vowel pattern can either pattern like verbs with a-a verbs or with i-i verbs, it is once again not possible to predict the vowels in one aspect from those in another; rather the class of the root is crucial.

Perfective verbs with the passive prefix n- or the middle/reflective -t- infix, but without an overt realization of little ν, have the same theme vowel as the perfective of the simple verbal form:

(56) a. Gulf Arabic theme vowel classes in the passive

Basic Perfective	Passive Perfective	Gloss
tiras	ntiras	'he filled/was filled'
simiʕ	nsimiʕ	'he heard/was heard'
ħatʃa	nħatʃa	'he talked/it was said'

b. Gulf Arabic theme vowel classes in the middle/reflexive

Basic Perfective	Middle/Reflexive Perfective	Gloss
simaʕ	stimaʕ	'he heard/listened to sth.'
ʤimaʕ	ʤtimaʕ	'he collected/had a meeting'
rabatˤ	rtabatˤ	'he tied sth./ was tied'

On the other hand, when there is an overt realization of little ν, the only possible vowel pattern for a Perfective verb is a-a:

(57) a. Causative:
ʕarraf 'he made s.o. acquainted with s.th.', darras 'he taught', kassar 'he smashed'

b. Applicative:
xaabar 'he telephoned', saafar 'he traveled', saamaħ'he forgave s.o.'

c. Inchoative:
ħmarr 'it turned red', ʕwarr 'he grew blind in one eye'

5.3 Iraqi Arabic

Iraqi Arabic also follows the same conditioning pattern. In the basic verbal form, Iraqi Arabic also three different possible theme vowels patterns, with different stems choosing different vowels in a largely idiosyncratic manner:

(58) a. a-a: ʔaxað 'to take', ʔakal 'to eat'[7]

b. i-a: ʔimal 'to hope', kitab 'to write', yibas 'to dry (intrans)'

c. u-a: ʔumar 'to command', tʕubax 'to cook', wusʕal 'to arrive'

[6] It also appears that at least the Abu Dhabi dialect has since lost vowel class distinctions, with the theme vowels being decided entirely based on phonological considerations (Al-Kaabi 2013).

[7] My source states that these are the only two triliteral verbs with this pattern

Erwin (2004) also mentions phonological considerations in predicting the theme vowel. It is a general tendency in the language that u's are more common than i's in the enviroment of pharygealized segments, emphatics, labials, velars and r. This is a tendency rather than a strict phonological regularity, and the near minimal pair [ʔimal] and [ʔumar] show that the theme vowel must be morphologically conditioned.

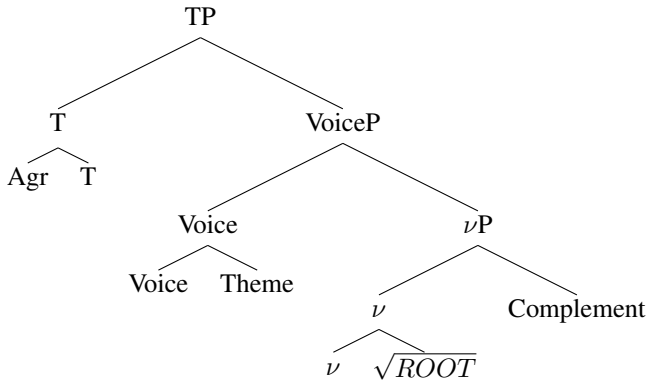
While the possible vowel patterns for Iraqi Arabic differ from those of Gulf Arabic, the generalization remains the same that the three way vowel-class distinction is preserved in the Passive and Middle/Reflexive, while being neutralized to a-a in the Causative, Applicative and Inchoative.

5.4 Analysis

The generalization across Akkadian and both dialects of Arabic is that theme vowel allomorphy can be conditioned by the root only when there is no overt realization of little ν. It is not the case, however, that different features on little ν condition different spell-outs of the theme vowels; rather any verb with an overt little ν morpheme (either concatenative or a non) will have the same theme vowel for a given combination of voice and aspect features, indicating a resort to a less-specified allomorph due to blocking of the conditioning environment.

I follow Oltra Massuet (1999) in assuming that theme vowels are the realization of a morphological well-formedness requirement on a syntactic functional head. In order for an overt realization of little ν, but not of Voice to block an allomorphy relationship between the root and the theme vowels, the theme vowel node needs to come between Voice and little ν. I suggest that in the languages under discussion, the morphological operation adjoins a theme vowel node to Voice, leading to the following structure:

(59)



Concatenation leads to the following representation for a 3rd singular Passive, Perfective verb in Akkadian:

(60) $\text{Agr}_{3s}{}^\frown\text{T}_{perf}{}^\frown\text{Voice}{}^\frown{}_{pass}\text{Theme}{}^\frown\nu{}^\frown\sqrt{}\text{ʃRQ}.$

Since the Theme node is within the same spell-out domain as Voice and Aspect, the syntactic features of these heads are available to condition contextual allomorphy. In this case, little ν has no features, and thus nothing is inserted (default null), making the Theme node adjacent to the root, so that it can therefore be conditioned by the root's phonological identity. On the other hand, in the case of a perfective causative verb, concatenation gives the following structure:

(61) $\text{Agr}_{3s}{}^\frown\text{T}_{perf}{}^\frown\text{Voice}{}^\frown\text{Theme}{}^\frown\nu_{caus}{}^\frown\sqrt{}\text{ʃRQ}.$

This little ν recieves the overt spell-out /ʃa-/ which intervenes so that the Theme node can no longer 'see' the identity of the root for the purposes of contextual allomorphy.

All realizations of little ν features in Arabic and Akkadian behave the same with respect to this blocking effect, however, aside from the causative, all the remaining forms are nonconcatenative (lengthening). Since the kind of locality condition necessary for this kind of blocking depends on concatenation (Embick 2010), nonconcatenative morphology is behaving like it is concatenated. If we represent lengthening as caused by a morpheme realized as an autosegment, then this implies that the autosegment is first concatenated in the morphology before being linearized onto another morpheme (presumably by the phonology proper).[8]

[8] Alternately, if we choose to represent morphological lengthening as a phonological adjustment triggered by a null morpheme, then this means that triggering such a rule is enough to count as intervening phonological material for locality purposes.

Embick (2013) has observed that morphophonological processes (such as lengthening) are local to the morphosyntactic position of the morpheme that triggers them. This follows from the theory I have been using that concatenates all varieties of morphemes according to a syntactic structure, but is not derivable in a theory that takes the non-linear phonological structure as a starting point for analyzing nonconcatenative morphology. Stem vowel allomorphy in Arabic and Akkadian is such a case where non-affixal morphemes behave as if they are concatenated in their appropriate morphosyntactic position exactly like affixal morphemes.

A list of some possible spell-out rules for Akkadian theme vowels is given below:

1. Theme $\leftrightarrow$ u / _ $T_{perfective}$ + {prs, bqr, dgl...}
2. Theme $\leftrightarrow$ a / _ {prs, bqr, dgl...}
3. Theme $\leftrightarrow$ i / _ {ʃrq, pqd, kbr...}
4. Theme $\leftrightarrow$ u / _ {mqt, knʃ, ʃmx...}
5. Theme $\leftrightarrow$ a /_ T_{imp}
6. Theme $\leftrightarrow$ i

The first four rules will derive the correct theme vowels for the basic forms by selecting the correct theme vowel with reference to the list of roots in each vowel class. These rules are the most specific, and thus are intrinsically ordered first. In forms with an overt realization of little ν, the context of the root is not available, and thus the more general rules (5) and (6) are used.

As they stand these rules do not capture the reduction of vowel classes and special theme vowel patterns of the passive. Spell-out rules for the passive theme vowels are less neat since the same result must be derived for three different classes. One possiblity is to use the rules given below:

1. Theme $\leftrightarrow$ i / _ Voice_{pass} + ʃrq, pqd, kbr...
2. Theme $\leftrightarrow$ i / _ Voice_{pass} + $T_{perfective}$
3. Theme $\leftrightarrow$ a / _ Voice_{pass}

These additional rules would need to be extrinsically ordered before the rules given above. This is not a particularly elegant solution, and perhaps a better analysis is in terms of an interaction between vowel class and the markedness of the syntactic environment, as suggested for Catalan by Oltra Massuet (1999). I leave this topic for further research, but whatever the solution, spell-out rules for theme vowels need to make reference to the identity of the root in the passive, but not in the context of overt little ν morphology. The analysis of Arabic would be very similar to that given for Akkadian, with the main exception being that the vowel classes are not reduced in the context of the passive, but rather in the context of the imperfective aspect.

An alternative analysis could argue that it is possible to derive the correct results for the theme vowels of Akkadian and Arabic without appealing to locality. Perhaps the theme vowel node is never prevented from being conditioned by the identity of the root, but it just happens to be the case that the vocabulary items in Gulf Arabic, for example, reference the context of the causative, applicative and inchoative morpheme rather than the root, while no vocabulary items reference the unmarked little ν, passive and middle/reflexive morphemes and the identity of the root is referenced here instead. I believe this analysis misses the generalization that these are not arbitrary groups of morphemes, but dependent on the syntactic position of the morpheme.

Stem based accounts like Ussishkin (2003) and Bat-El (1989) also cannot capture the regularity since this approach concatenates different vowel patterns with the verbal stem, using melodic overwriting to replace the original stem vowels. These accounts predict that any vowel pattern should be possible for any set of syntactic features since there is no structural position between the stem and the vowels.

5.5 Summary

I have argued in this section that regularities in the theme vowels of Arabic and Akkadian verbs follow from precedence-based locality restrictions on allomorphy. This analysis depends on these theme vowels being independent morphological entities. A theory such as Ussishkin (2003) or Bat-El (1989) where vowels are stored with the stem and different vowel patterns are derived by phonological overwriting can derive any possible pattern of verbal vowels, rather than the restricted possible patterns that are actually seen.

The fact that apparently non-concatenative morphemes like lengthening play a role in morphosyntactic locality restrictions is also further evidence that these alternations should be treated concatenatively. Furthermore, root-conditioned allomorphy blocking follows from morphosyntactic allomorphy selection, as in Distributed Morphology, rather than phonological allomorphy selection, as in various OT theories of morphology, which have no mechanism to

impose local selection (Embick 2010). This is another example of nonconcatenative morpheme realization depending on morphosyntactic structure, rather than being a phonological phenomenon.

6 Templatic Effects

The tradition of Semitic linguistics has long observed that the output shape of words in these languages are extraordinarily consistent, leading to the description of the languages as being templatic. In this section, I will show that templatic effects can be derived from the interaction of prosodic constraints sensitive only to phonological structure and not to the morphosyntactic structure (contra McCarthy 1981, Tucker 2010).

6.1 Stem Maximality in Arabic

Tucker (2010) points out that uninflected verbs in Iraqi Arabic never exceed two syllables in length. This is also true of Gulf Arabic. He enforces this with a prosodic constraint also used by Ussishkin (2003), based on Ito et al. (1996):

(62) σ Align: assign a violation for any syllable which is not aligned to the edge of some prosodic word containing it

Since this constraint does not hold on the surface for inflected verbs or for non-verbs, he hypothesizes that higher ranked constraints on morphological realization can over-rule it. Another possibility is that this is like a Morpheme Structure Constraint (Chomsky and Halle 1968) in only being applicable to verb stems.[9] The fact that certain phonological requirements apply only to some lexical categories is not unusual cross-linguistically (Smith 2011).

I follow Tucker's basic intuition that stem maximality effects arise from prosodic constraints, but differ in basing the constraint on alignment of feet instead of syllables. Limiting the stem to a foot can be derived without special constraints by the simultaneous application of All-Ft-L and All-Ft-R. I will first analyze the stress systems of Gulf and Iraqi Arabic to show this analysis is viable, and then I will demonstrate why it is superior.

6.1.1 Stress System of Gulf Arabic

Stress in Gulf Arabic goes on the ultima if it has a long vowel or if it is closed by a geminate or sequence of two consonants. This behavior is consistent with the final consonant being appended (Rosenthall and Van der Hulst 1999, McCarthy 1993, Tucker 2010):

(63)

ʕa.leé	'on him'
ga.raa.tˤíis	'pieces of paper'
ðˤ aħ.hátʃtʃ	'he made you laugh'
fannáʃt	'I resigned'

Otherwise, stress goes on the penultimate syllable:

(64)

sí.matʃ	'fish'
ta.bíin.ha	'you want it'
mad.rá.sa	'school'
ma.ʕaa.zíib.hum	'those responsible for the elders'
kar.ráa.ni	'clerk'

Since HLL words are stressed on the penult, this indicates that the language is right-aligned trochaic and that weight cannot attract stress leftward. In addition, in order for HH words to be stressed on the ultima, it must be the case that heavy syllables cannot be footed together. This makes sense if there is moraic rather than syllabic Foot Binarity, and heavy syllables are penalized in the weak branch of a foot:

(65) WSP-FT : assign a violation for a heavy syllable in the weak branch of a foot (Kager 1997)

[9] This intuition is similar to that of Stratal OT in that different grammars can apply at different points in the derivation (Kiparsky 2000).

This constraint is different from the general WSP in that it specifically penalizes HH feet rather than also penalizing unfooted heavy syllables (Prince 1990).

If this constraint is ranked over Parse-σ (assign a violation for every syllable not in a foot), then it will cause the language to avoid footing two heavy syllables together since one will have to be in the weak branch.

(66) Gulf Arabic general stress system (HH)

/fannaʃt/	FT-BIN	ALL-FT-R	WSP_{weak}	PARSE-σ	NONFIN-FT	WSP
☞ fan.(náʃ)t				*		*
(fán.naʃ)t			*W	L		*

WSP-FT $\gg$ PARSE-σ

6.1.2 Stress System of Iraqi Arabic

In Iraqi Arabic stress goes on the ultima if it is heavy (where once again, the final consonant does not count towards weight):

(67)
ʧaa.kúuʧ	'hammer'
taʕ.báan	'tired'
ma.záll	'place'

else on the penult if it is heavy or in LL words:

(68)
náa.di	'club'
ní.sa	'he forgot'
sal.lát.ha	'her basket'

else on the ante-penult:

(69)
mád.ra.sa	'school'
ʃá.ri.ka	'company'
mu.máθ.θi.la	'actress'

LLL words are stressed on the first syllable, which indicates that the language is trochaic.Since HH words are stressed on the ultima, the feet must be right-aligned with the same WSP_{weak} constraint as Gulf Arabic:

(70) Iraqi Arabic general stress system (HH)

/taʕbaan/	WSP_{weak}	ALL-FT-R	ALL-FT-L	NONFIN-FT	PARSE-σ
☞ taʕ.(báa)n			*		*
(táʕ.baa)n	*W		L		L
(t'aʕ).baan		*W	L		

WSP_{weak} $\gg$ PARSE-σ; ALL-FT-R $\gg$ ALL-FT-L

The winner above does not violate NONFINALITY-FT since the appended consonant intervenes between the foot and the edge of the prosodic word. NONFINALITY-FT is active, serving to give stress on the ante-penult despite the right-aligned system:

(71) Iraqi Arabic general stress system (LLL)

/ʃarika/	TROCHEE	NONFIN-FT	ALL-FT-R	ALL-FT-L
☞ (ʃá.ri).ka			*	
ʃa.(rí.ka)		*W	*L	*W

NONFIN-FT $\gg$ ALL-FT-R

6.1.3 Stem Maximality as a Foot Alignment Constraint

An analysis of stem maximality that uses foot alignment constraints can explain both why there are no tri-syllabic verb stems, and why there are no HH verb stems, while syllable alignment can only explain the first fact, since HH verbs do not violate syllable alignment. Additionally, foot alignment can explain why the surface form of the inchoative is $C_1C_2VC_3C_3$ (e.g. [mtann]) and not $C_1VC_2VC_3C_3$ (e.g. *[matann]). As mentioned previously foot alignment can be derived by simultaneous use of ALL-FT-R (which we have already seen as active in the stress systems) and ALL-FT-L. Since the maximality restriction only applies to Verb stems, I will use a version of this constraint specific to verbs that only is active at the stem level in a stratal derivation:

(72) ALL-FT-L_{Verb}: Assign a violation for every syllable that intervenes between the left edge of a foot and the left edge of a verbal prosodic word

In order to satisfy the maximality requirement enforced by the foot alignment constraints, vowel deletion is preferred to deletion of the moraic affix due to the high ranking of the following constraint:

(73) MAX-FLT: Assign a violation for an autosegment that is floating in the input, which doesn't have a correspondent in the output (Wolf 2007)

The analysis is shown below with constraint rankings consistent with the stress analysis of both dialects:

(74) Stem maximality in Arabic inchoative verbs

/matan-μ/	TROCH	WSP_{weak}	ALL-FT-R	ALL-FT-L_{verb}	MAX-FLT	MAX
☞ (mtán[μ])n						*
(ma.tán[μ])n	*W					L
(má.tan[μ])n		*W				L
ma.(tán[μ])n				*W		L
(má.ta)n					*W	L

Thus, in order to allow gemination of the final consonant with the stem still being a single foot, vowel syncope creating a single heavy syllable is preferred to violating the stress constraints of the language. On the other hand, we have seen that quadriliterals occur in Form IX with the shape $C_1C_2VC_3VC_4C_4$ (as in [tʕmaʔann]). I suggest that these forms are footed as iambs (e.g. [(tʕma.ʔán)n]). Trochee is violated so that gemination can be realized without violating stem maximality. Since there are no HH verbs (see also the next section), (HH) must be a worse foot than (LH).

6.2 Restrictions on Quadriliterals in Arabic

As was mentioned in Section 3.1, quadriliterals in Arabic apparently do not occur in the causative or applicative. This fact is derivable in frameworks that use CV-skeleton templates (McCarthy 1981, Yip 1988), under the assumption that no CV-skeleton is available that can accomodate four root consonants and lengthening. More recent accounts that attempt to be less stipulative, such as Ussishkin (2003) or Tucker (2010), do not attempt to analyze this fact. In this section, I show that the non-existence of quadriliterals in certain forms can be understood as similar to Akkadian gemination blocking, where the surface realization of a morpheme would violate high-ranked prosodic constraints.

For a quadriliteral verb like [barhan], any attempt to realize the moraic causative morpheme by gemination would lead to a problematic structure:[10]

(75) a. Neither *[barrhan] nor [barhhan] can be syllabified licitly since neither dialect allows medial complex onsets or codas

b. *[bar.ra.han] with epenthesis has three syllables, and thus violates Stem Maximality

c. *[barrahn] by being a HH word also violates Stem Maximality, since as I have argued, this cannot be parsed as a single foot in these dialects

d. *[brahhan] has a legal syllable structure and the same HL prosodic shape as attested causatives, but it is never generated so long as the mora is aligned to the already syllabified form /bar.han/, and metathesis of the /r/ and /a/ cannot co-occur with the positioning of the mora

[10] Yip (1988) makes a similar observation also about Arabic.

Similarly, a realization of the mora for the applicative also leads to a marked structure:

(76) a. *[baar.han] has a super-heavy first syllable

This last form is less obviously categorically bad. While Gulf Arabic has no super-heavy syllables, Iraqi Arabic allows them in the nominal domain (e.g. [raad.yow.wat] 'radio') and as a result of syncope in verbal forms (e.g. [xaab.ra.ta] 'she phoned him' from /xaabar-ata/). We have already seen special prosodic requirements for verbs as opposed to nouns. In the syncope cases, this structure is created by an unfaithful phonological mapping rather than simply by morphological realization. Perhaps then the avoidance of super-heavy syllables in verbal stems is a sort of Non-Derived Environment Blocking (Wolf 2008).

There are two possibilities for how Arabic avoids these phonologically ill-formed forms of quadriliteral verbs. The moraic affix could be present in the morphosyntactic structure, but deleted from the surface of the phonology, making the causative and applicative of quadriliterals impossible to differentiate from basic forms. Alternately, the phonological ill-formedness could lead to a paradigm gap. McCarthy and Wolf (2007) argue that in certain cases the phonology has no repair for a marked structure created by the morphology, and selects a null parse of the word.

For Akkadian gemination blocking, I have assumed the first case to be true, since verbs without overt gemination can still be used in the appropriate syntactic environment for imperfectives without a problem. This is a tricker question for Arabic since the basic form is compatible with any argument structure. If enough cases were found where the same quadriliteral had two distinct uses as an intransitive and a causative, for example, this would indicate that two different morphosyntactic structures underlie the same phonological form. The absence of such cases, on the other hand, does not prove anything, since roots in Arabic derivational morphology can select features on little ν idiosyncratically. Thus not every verb is expected to appear in every form and not every form can be identified by its meaning.

In any case, these forms can be blocked by output well-formedness determined by the phonology, which is specific to verbs, but does not need to reference the identity of the particular morphemes or morphosyntactic structure.

An alternative analysis could posit that quadriliterals all happen to belong to a class of roots that do not select causative or applicative little ν features. Since the syntax presumably cannot count the number of consonants in a root, it would be a complete accident that this is true of every single quadriliteral. My analysis is less arbitrary since independent phonological considerations can rule out the forms discussed above.

On the other hand, a morphosyntactic selection story might be correct for Akkadian quadriliterals. McCarthy (1993) points out that Akkadian quadriliterals always have an /r/ or an /l/ as their second consonant, indicating that this consonant should be analyzed as an infix rather than a root consonant. This means that all "quadriliteral" verbs in Akkadian have a complex morphosyntactic structure. If whatever (perhaps semantically vacuous) syntactic feature corresponds to the infixal consonant is incompatible with certain other syntactic features, then the fact that these verbs do not appear in certain forms is no longer an arbitrary property of their roots.

7 Conclusion

This paper has examined the relationship between syntactic structure, nonconcatenative morpheme realization and prosodic structure in the morphology of Akkadian and two dialects of Arabic. We have seen that nonconcatenative morphemes such as those that cause lengthening can choose an infixal position in the phonological structure they combine with, but do not specify a resulting prosodic shape. Rather, the phonological constraints of the language can enforce a specific shape for a stem that is insensitive to morphological structure, as in the interaction of lengthening and word maximality in Arabic. Despite the fact that the phonological appearance of the morphemes is nonconcatenative, reference to the linearized syntactic structure is necessary both for describing allomorphic locality conditions (the case of theme vowel selection), as well as phonological cyclicity (for example in Akkadian gemination blocking). Further research will determine whether these implications can lead to insights into the syntax-phonology interface cross-linguistically.

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