Cyclicity and prosody in Armenian stress-assignment

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Abstract

The morphology-phonology interface is rife with examples of interactions between the two modules. Various theoretical models have been proposed to either a) cover the entire interface, or b) cover a subset of this interface. Lexical Phonology and Prosodic Phonology are two popular models of how this interface operates. However it is an open question if both models are needed and if one can do the job of the other.

In this paper, data from Armenian morpho-phonology shows the need for both models to be combined and used as one single model for the interface. Crucially, data on Armenian stress assignment and destressed vowel reduction necesitates using both Lexical Phonology's concepts of cyclicity and strata and Prosodic Phonology's concepts of prosodic stems and prosodic non-isomorphism.

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Hossep Dolatian*

1 Introduction

More often than not, phonological processes are sensitive to morphological structure (Inkelas 2014). Because of the breadth of cross-linguistic research on the many ways that phonology and morphology interact, multiple theoretical frameworks have been proposed in order to handle the vast data. Two prevalent frameworks are the procedural approach of Lexical Phonology (Kiparsky 1982, 2015, Bermúdez-Otero 2011) and the representational approach of Prosodic Phonology (Nespor and Vogel 1986, Selkirk 1996, 2011).

Given two different frameworks like Lexical Phonology and Prosodic Phonology, two questions are often asked: *Which framework is empirically necessary,* and *which framework has both descriptive and explanatory adequacy?* Some theorists argue that either (Nespor and Vogel 1986), both (Inkelas 1989, Mansfield 2017), or only one of the approaches (Kaisse 1985, Scheer 2011) is necessary and adequate. This paper argues for the second approach: that both Lexical Phonology and Prosodic Phonology are needed and that they interact to form the morphology-phonology interface. Evidence for this position will be brought from Armenian.

Armenian is an Indo-European language with two standard dialects, Standard Western and Standard Eastern Armenian.[1] Morphologically, Armenian is agglutinative and primarily suffixing. This paper will discuss data on stress assignment and vowel reduction across the two dialects. The two processes will be shown to involve complex morpho-phonological interactions which necessitate merging Lexical Phonology and Prosodic Phonology into one interface model. This is because describing and understanding these two phonological processes requires using a) Lexical Phonology's concepts of cyclicty and strata (stem vs. word-level cophonologies), and b) Prosodic Phonology's concepts of phonological constituents (i.e., prosodic stems) and prosodic misalignment or non-isomorphism.

This paper is organized as follows. Section 2 discusses stress and stress-dependent phonology in both Armenian dialects, specifically primary stress assignment (Section 2.1) and destressed high vowel reduction (Section 2.2). Section 2.2 deals only with the phonological factors which control vowel reduction, while its morphological factors are described in Section 2.3. Section 3 discusses the interaction between the phonology and morphology of vowel reduction across the dialects. A Lexical Phonology account is set up for Western Armenian in Section 3.1. For Eastern Armenian, this is later augmented with the prosodic constituents of Prosodic Phonology in Section 3.2 in order to explain the dialectal differences. Conclusions and discussion are in Section 4.

2 Stress and Stress-dependent Phonology in Armenian

2.1 Primary Stress Assignment

In both Standard Western and Standard Eastern Armenian, stress falls on the final full-vowel in the word (1) (Vaux 1998). A vowel is full if it is not a schwa. If the final vowel is a schwa, then stress is on the penultimate syllable (1d).

(1)	a.	kórd͡z	'work'
	b.	kord͡z-avór	'worker'
	c.	kord͡z-avor-nér	'workers'

*Many thanks for Irene Vogel who was there from the start. My gratitude to her, Jeffrey Heinz, Christina Bethin, Laura Downing, and the phonologists of Delaware and Stony Brook.

[1]Western and Eastern Armenian are distinguished by a set of consonant shifts, e.g., Western k^hirk^h vs. Eastern $girk^h$ 'book'. For simplicity, all consonants in the examples are transcribed in the Western variant and aspiration is not marked. Aspiration and consonant differences do not affect stress or vowel reduction.

d. kor͡dz-avor-nér-ə ‘the workers’

Morphologically, it does not matter if the rightmost full vowel is part of the root (1a), a derivational suffix (1b), or an inflectional suffix (1c). However, stress does not fall on enclitics (2).

(2) a. kor͡dz-avor-nér en ‘(they) are workers’
b. kor͡dz-avor-nér al ‘also workers’
c. kor͡dz-avor-nér al en ‘(they) are also workers’

Within the framework of Prosodic Phonology (Nespor and Vogel 1986, Vogel 2008, Selkirk 2011), the largest domain for stress assignment in Armenian is the phonological or prosodic word (PWord) which is mapped from the morphological word (MWord). In the case of Armenian, stress falls on the final full vowel of the PWord. Because all suffixes are eligible for getting primary stress, this makes the PWord isomorphic with the MWord. Figure (1) illustrates the mapping of (2a).

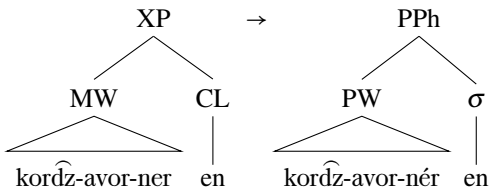


Figure 1: Mapping MWord to PWord for *kor͡dz-avor-nér en* (2a).

The fact that clitics cannot bear primary stress means that they do not incorporate into the PWord. This falls out from the isomorphism of the MWord and PWord. Clitics will not be further discussed.[2] All examples will consist of one word, i.e., an isomorphic MWord and PWord. Word boundaries will not be placed in the examples.

2.2 Phonology of Destressed High Vowel Reduction

Although primary stress appears only once on the surface,[3] there is evidence that stress is being actively assigned and reassigned cyclically as every suffix is added. The evidence is the reduction of destressed high vowels to a schwa (3a) or nothing (3b).

(3)	a.	i.	hín	‘old’	b.	i.	teʁín	‘yellow’
		ii.	hən-utjún	‘oldness’		ii.	teʁn-orág	‘yellowish’

In terms of its phonological factors, reduction targets only *high* vowels which surface as unstressed in the output (4). Low and mid vowels do not reduce (5).[4]

(4)	a.	i.	makúr	‘clean (adj)’	b.	i.	badíʒ	‘punishment’
		ii.	makr-él	‘to clean’		ii.	badʒ-él	‘to punish’

[2] In this paper, I am agnostic over where clitics are prosodified: into the phonological phrase (Selkirk 1996), the composite group (Vogel 2009), or recursively into a larger PWord (Ito and Mester 2009). The role of clitics will not affect any of the data or analysis in this paper.

[3] Armenian is reported to have secondary stress on the initial syllable (Vaux 1998) but its acoustic cues are weak. Secondary stress likewise does not affect vowel reduction synchronically; though see DeLisi 2015 for evidence on the diachronic role of initial secondary stress.

[4] A closed set of words have the vowel /e/ undergo destressed reduction to [i]: sér→[sir-él] ‘love’→‘to love’.

(5)	a.	i.	had͡ʒáχ	‘frequent (adj)’	b.	i.	darpér	‘different’
		ii.	had͡ʒaχ-él	‘to frequent’		ii.	darper-él	‘to differentiate’
		iii.	* had͡ʒχ-él			iii.	* darpr-él	
	c.	i.	ʒoʁóv	‘assembly’				
		ii.	ʒoʁov-él	‘to collect’				
		iii.	* ʒoʁv-él					

Vowel reduction likewise reduces a falling high diphthong like *uj* to *u* (6). In contrast, non-high diphthongs like *aj* (7a) or rising high diphthongs like *ju* (7b) do not reduce.

(6)	a.	i.	gabújd	‘blue’	b.	i.	kújn	‘color’
		ii.	gabud-ód	‘blueish’		ii.	kun-avór	‘colorful’
		iii.	* gabd-ód			iii.	* kujn-óvor	
(7)	a.	i.	t͡sajn	‘voice’	b.	i.	jeʁt͡ʃjúr	‘horn’
		ii.	t͡sajn-él	‘to phone’		ii.	jeʁt͡ʃjur-avór	‘having horns’
		iii.	* t͡san-él			iii.	* jeʁtʃur-avór	

Second, not just any unstressed high vowel in the output will reduce. Although it is cross-linguistically common for vowel reduction to target any unstressed vowel or any unstressed high vowel (Crosswhite 2001), the same cannot be said for Armenian. A high vowel will reduce only if it was stressed at some point of the derivation but subsequently lost stress, i.e., it is *destressed* (8).

(8)	a.	i.	irigún	‘evening’	b.	i.	amusín	‘husband’
		ii.	irign-ajín	‘evening (adj.)’		ii.	amusn-anál	‘to marry’
		iii.	* irgun-ajín			iii.	* amsin-anál	

To illustrate this point, consider the example *irigún* (8a-i) which consists of three high vowels. In the underived base word, none of the high vowels are reduced and stress is on the final vowel. However, once a suffix *-ajin* is added onto the base, stress will shift onto the suffix and the derivative will be *irign-ajín* (8a-ii). The root's final high vowel will have lost stress and is reduced in the derivative. The other high vowels in the base do not reduce (8a-iii). The same destressing process is observed in *amusín* vs. *amusn-anál* (8b).

Even if a word contained both high vowels and non-high vowels (9a), the high vowels will not reduce in the derivative if they were never stressed in the base. Likewise, if suffixation did not trigger stress shift (9b), then there is no reduction. Thus, high vowel reduction targets only *destressed* high vowels, not simply *unstressed vowels*.

(9)	a.	i.	kiʃér	‘night’	b.	i.	darí	‘year’
		ii.	kiʃer-ajín	‘nocturnal’		ii.	darí-k	‘age’
		iii.	* kʃer-ajín			iii.	* dár-k	

A reduced high vowel has two possible outputs: a schwa (10a) or nothing (10b), i.e. deletion. The choice between these two options is based on permissible and impermissible syllable margins.

(10)	a.	i.	kír	‘letter’	b.	i.	barsíg	‘Persian’
		ii.	* kr-ít͡ʃ	‘pen’		ii.	barsg-astán	‘Persia’
		iii.	kər-ít͡ʃ	‘pen’				

A destressed high vowel will preferably delete (10b). However, if deletion would cause a complex onset or a complex coda with rising sonority, then the high vowel will reduce to a schwa instead

(10a). This is because complex onsets are banned in Armenian, while complex codas have to obey the Sonority Sequencing Principle.[5]

Finally, just as stress assignment is cyclic, so is destressed vowel reduction. Vowel reduction can apply multiple times to a sequence of destressed high vowels (11a) or high diphthongs (11b). This is a case of unbounded cyclicity (Orgun 1994) where every new suffix can potentially trigger a new cycle of stress shift and reduction.

(11)	a.	i.	d͡zín	'birth (of animal)'	b.	i.	lújs	'light'
		ii.	d͡zən-únt	'birth'		ii.	lus-avór	'illuminous'
		iii.	d͡zən-ənt-agán	'generative'		iii.	lus-avor-íṭ͡ʃ	'illuminator'
						iv.	lus-avor-ṭ͡ʃ-agán	'Apostolic'

The phonological factors for destressed vowel reduction are summarized in (12). Because of space, I do not formalize these factors, but see Khanjian (2009) for a plausible formalization using Comparative Markedness (McCarthy 2003). The next section will discuss the morphological factors behind vowel reduction, specifically its cyclicity and its sensitivity to different types of suffixes.

(12) **Primary phonological factors for vowel reduction**

1. A vowel will reduce when the vowel
   (a) is a high vowel /u, i/ or a high diphthong /uj/ which surfaces without stress, and
   (b) is destressed, i.e., it surfaced with stress in a previous stage of the derivation but subsequently lost it.
2. The output of reduction will be:
   (a) if /i, u/, then either nothing (if deletion won't create bad syllable margins) or a schwa (to prevent an impermissible onset/coda clusters);
   (b) if /uj/, then [u].
3. Both stress shift and destressed reduction can apply multiple times.

2.3 Morphology of Reduction

In the previous section, all suffixes which triggered stress shift likewise triggered destressed reduction. We also saw that the addition of multiple suffixes could trigger multiple rounds of stress assignment and vowel reduction (13).

(13)	a.	d͡zín	'birth (esp. of animals)'
	b.	d͡zən-únt	'birth'
	c.	d͡zən-ənt-óṭ͡s	'genesis'

However, although all types of suffixes trigger stress shift, not all of them can trigger reduction. This section discusses what morphological factors govern reduction. Specifically, this section shows that a) there is a derivation vs. inflection split in the triggers for reduction, and b) that the dialects systematically differ in what can or cannot trigger reduction.

In both Western (WA) and Eastern Armenian (EA), derivational suffixes trigger both stress shift and vowel reduction (14b). In fact, all of the reduction examples in Section 2.2 involved derivational suffixes. But, we see dialectal differences in how inflectional suffixes interact with stress shift and vowel reduction.

(14)	a.		amusín	'husband'	
	b.	Derivation	amusn-agán	'marital'	WA & EA
	c.	V-initial Infl.	amusn-óv	'husband-INST'	EA
	d.	V-initial Infl.	amusin-óv	'husband-INST'	WA
	e.	C-initial Infl.	amusin-nér	'husband-PL'	WA & EA

[5]The exception to the SSP is that word-final complex codas can include an appendix *-k*, e.g., *bardk* 'debt'.

Inflectional suffixes trigger stress shift in both dialects. However, in Western Armenian, inflectional suffixes do *not* trigger vowel reduction (14d,14e). As for Eastern Armenian, consonant-initial (C-initial) inflectional suffixes (14e) cannot trigger vowel reduction while vowel-initial (V-initial) ones *can* (14c). Table 1 summarizes the morphological dichotomies we find for vowel reduction across the two dialects. The next section formalizes and explains these dichotomies.

Dialect	Derivation	Inflection (V-initial)	Inflection (C-initial)
Western Armenian	✓	✗	✗
Eastern Armenian	✓	✓	✗

Table 1: Summary of morphological factors of vowel reduction in Western and Eastern Armenian.

3 Morpho-phonology of Reduction

This section will describe, explain, and formalize the morphological factors of vowel reduction. It does so incrementally by first explaining and formalizing the behavior of vowel reduction in the relatively simpler case of Western Armenian in Section 3.1. There, I develop a Lexical Phonology account which crucially involves cycles and different strata. Section 3.2 handles Eastern Armenian by augmenting this Lexical Phonology account with prosodic constituents and prosodic misalignment.

3.1 Western Armenian: A Lexical Account

In the case of Western Armenian, all suffixes trigger stress shift. We likewise find that the addition of multiple (derivational) suffixes triggers multiple rounds of stress shift and vowel reduction (15,16). For example, the roots *amusín* (15a) and *d͡zin* (16a) were initially assigned final stress. The derivative *amusn-agan* (15b) underwent one round of stress shift and reduction from the root *amusin* by adding the suffix *-agan*; whereas, *d͡zən-ənt-ot͡s* (16c) underwent two rounds of stress shift and vowel reduction by incrementally adding the derivational suffixes *-unt* (16b) and *-ot͡s* (16c) to the root *d͡zín*.

(15)	a.	amusín	‘husband’	(16)	a.	d͡zín	‘birth (esp. of animals)’
	b.	amusn-agán	‘marital’				
	c.	amusin-óv	‘husband-INST’		b.	d͡zən-únt	‘birth’
	d.	amusin-nér	‘husband-PL’		c.	d͡zən-ənt-ót͡s	‘genesis’
					d.	d͡zən-unt-í	‘birth-GEN’

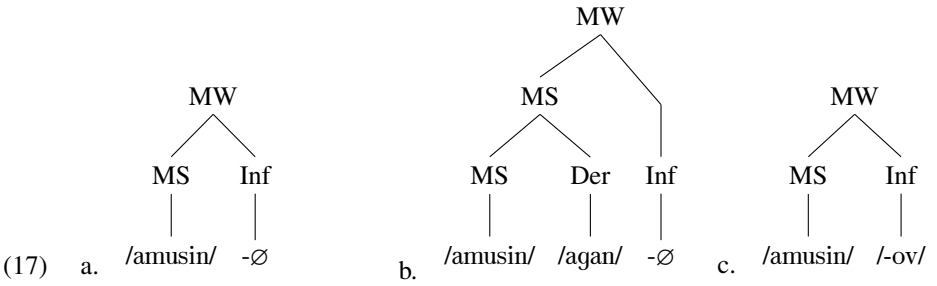
However, we find a clean split over what types of suffixes can or cannot trigger vowel reduction: derivational suffixes like *-agan* (15b) *-unt* (16b), and *-ot͡s* (16c) can trigger reduction, while inflectional suffixes like *-ov* (15c), *-ner* (15d), and *-i* (16d) cannot.

The above pattern lends itself to an account using Lexical Phonology (Kiparsky 1982, 2015) that crucially uses two strata: a stem-level cophonology and a word-level cophonology. Before we develop and formalize the Lexical Phonology account of Western Armenian, we need to first determine what is the morphological structure of free-standing roots like *amusín* (15a) or *d͡zín* (16a), their derivatives (15b;16b,16c), and their overtly inflected versions (15c,15d;16d).

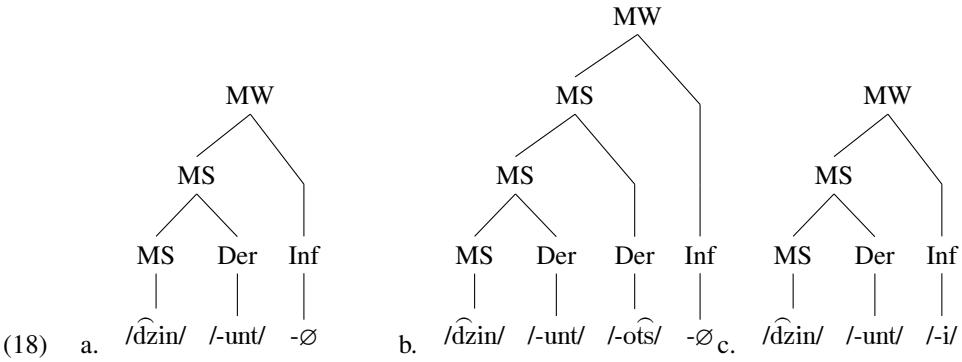
In terms of morphology, free-standing roots like *amusín* (15a) or *d͡zín* (16a)[6] and derivational suffixes form Morphological Stems (MStems), while inflectional suffixes (whether null or overt) form Morphological Words (MWords). Although the plural (15d) and oblique cases (16d, 15c) involve overt suffixes, a singular nominative noun like *amusín* or *d͡zən-ənt-ót͡s* (16c) bears no overt inflectional suffix. For simplicity, we assume that it forms an MWord with a covert inflectional suffix. The trees in (17a-c;18a-c) show the morphological structure for (15a-c;16b-d) respectively.

[6]Within Distributed Morphology (Halle and Marantz 1993), a free-standing root would get their part of speech by merging with a covert category head like *n*. For illustrative purposes only, I do not represent free-standing roots that way.

(17)



(18)



When these morphological structures are spelled-out into the phonology, an MStem enters the stem-level cophonology where **Stress Assignment** and **Vowel Reduction** are active phonological processes. Complex morphological structures can pass through the stem-level cophonology multiple times, i.e., cyclically, when they contain one or more derivational suffixes. In contrast, MWords trigger the word-level cophonology where Stress Assignment is active but not Vowel Reduction.

Table 2 illustrates the cyclic derivation of *amusn-agán* (15b), *amusin-óv* (15c), *d͡zən-ənt-ót͡s* (16c), and *d͡zən-unt-í* (16d) with a serialist Lexical Phonology.[7] Note that the subscript $_S$ marks MStems and $_W$ marks MWords, while the label SLevel is for the stem-level cophonology and WLevel for the word-level cophonology.

Input		amusin$_S$ -agan$_W$	amusin$_S$ -ov$_W$	d͡zin$_S$ -unt$_S$ -ot͡s$_S$ -∅$_W$	d͡zin$_S$ -unt$_S$ -i$_W$
SLevel	Stress	amusín	amusín	d͡zín	d͡zín
	Reduction				
SLevel	Stress	amusin-agán		d͡zin-únt	d͡zin-únt
	Reduction	amusn-agán		d͡zən-únt	d͡zən-únt
SLevel	Stress			d͡zin-unt-ót͡s	
	Reduction			d͡zən-ənt-ót͡s	
WLevel	Stress	amusn-agán	amusin-óv	d͡zən-ənt-ót͡s	d͡zən-unt-í
Output		[amusn-agán]	[amusin-óv]	[d͡zən-ənt-ót͡s]	[d͡zən-ənt-í]

Table 2: Serial Lexical-Phonology spell-out for *amusn-agán* (15b), *amusin-óv* (15c), *d͡zən-ənt-ót͡s* (16c), and *d͡zən-unt-í* (16d).

In sum, the Lexical Phonology account sketched above captures both the cyclicity and the derivation vs. inflection split observed in Western Armenian vowel reduction. The next section builds on top of the current Lexical Phonology account in order to handle Eastern Armenian.

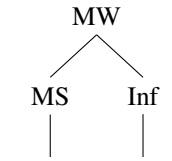
[7] The analysis can be easily extended into Stratal OT as long we allow multiple passes through the stem-level stratum. For reasons of space and simplicity, I only show a serialist account.

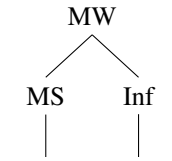
3.2 Eastern Armenian: A Prosodic Augmentation

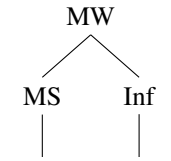
Recall that the two dialects differed in how they treat vowel-initial inflection. In Western Armenian, neither V-initial (19d) nor C- initial inflection (19e) could trigger vowel reduction. However, in Eastern Armenian, V-initial inflection (19c) could trigger reduction while C-initial (19e) could not.

(19)	a.	amusín	'husband'	
	b.	amusn-agán	'marital'	
	c.	amusn-óv	'husband-INST'	EA
	d.	amusin-óv	'husband-INST'	WA
	e.	amusin-nér	'husband-PL'	WA & EA

The three inflected items *amusn-ov* (EA: 19c), *amusin-ov* (WA: 19d), and *amusin-ner* (WA & EA: 19e) have the same morphological structure across the two dialects, represented in (20).[8]

(20) a.


b.


c.


The ability of Eastern V-initial inflection to trigger reduction is because of phonology, not morphosyntactic structure. For example, the plural suffix has two phonologically-conditioned suppletive allomorphs: *-er* after monosyllabic bases (21a) while *-ner* after polysyllabic bases (21b). In Eastern Armenian, the V-initial allomorph *-er* triggers reduction (22) while the C-initial one *-ner* does not (22b). Their (in-)ability trigger reduction is purely phonological.

(21)	a.	i.	ház	'cough (n)'	b.	i.	daráz	'costume'
		ii.	haz-ér	'coughs (n)'		ii.	daraz-nér	'costumes'

(22)	a.	i.	mís	'meat'	b.	i.	amís	'month'
		ii.	mis-ér	'meats (WA)'		ii.	amis-nér	'months'
		iii.	məs-ér	'meats (EA)'		iii.	* aməs-nér	'months'

In sum, in both dialects, V-initial inflection is a morphologically word-level suffix, i.e., it forms MWords. In Western Armenian, V-initial inflection triggers the word-level cophonology of stress shift without vowel reduction. However, in Eastern Armenian, it exceptionally triggers the stem-level cophonology of stress shift *with* vowel reduction. Table 1 summarizes this.

The fact that the distinction is based on being V-initial vs. C-initial points to an explanation based on syllabification and prosody. Within Prosodic Phonology, various mismatches have been documented between morphological constituents vs. phonological or prosodic constituents triggered by prosodic well-formedness conditions such as syllabification (Nespor and Vogel 1986, Selkirk 1996, 2011).

In the prosodic hierarchy of phonological constituents (P-constituents), the lowest morphosyntactically derived P-constituent is the PWord. However, in the case of agglutinative languages like Armenian, a smaller P-constituent has been argued to exist: the phonological stem or PStem which is derived from the MStem (Downing 1999). The PStem has been argued to play a role when derivational and inflectional morphology display mismatches within the MWord/PWord (Downing 2016).

For Armenian, I argue that the prosodic misalignment of the PStem is what triggers the unexpected behavior of V-initial inflection in Eastern Armenian. Specifically, in Western Armenian,

[8]Note that for Eastern Armenian *amusn-óv* (EA: 19c), the tree in (20a) shows the underlying representation of the root before vowel reduction had applied.

the PStem stays aligned or isomorphic with the MStem under both V-initial and C-initial inflection; while in Eastern Armenian, the PStem becomes misaligned with the MStem because it prefers to be aligned with syllable boundaries. Once misaligned because of V-initial inflection, the PStem in Eastern Armenian triggers an extra round of the stem-level cophonology of vowel reduction.

In this paper, I will only provide an informal illustration of the above data.[9] Table 3 shows the derivation of *amusn-ov* (EA: 19c), *amusin-ov* (WA: 19d), and *amusin-ner* (WA & EA: 19e) across the two dialects. PStem boundaries are marked by $(...)_s$.

a.	Input		Eastern amusin$_S$ -ov$_W$	Western amusin$_S$ -ov$_W$	Both amusin$_S$ -ner$_W$
b.	SLevel	Stress Reduction	(amusín)$_s$	(amusín)$_s$	(amusín)$_s$
c.	Spell out & syllabify Infl.		(amusi.n)$_s$-ov	(amusi.n)$_s$-ov	(amusin.)$_s$-ner
d.	Readjust PStem in Eastern		(amusi.n-ov)$_s$		
e.	Reiterate SLevel	Stress Reduction	amusin-óv amusn-óv		
f.	WLevel	Stress	amusn-óv	amusin-óv	amusin-nér
g.	Output		[amusn-óv]	[amusin-óv]	[amusin-nér]

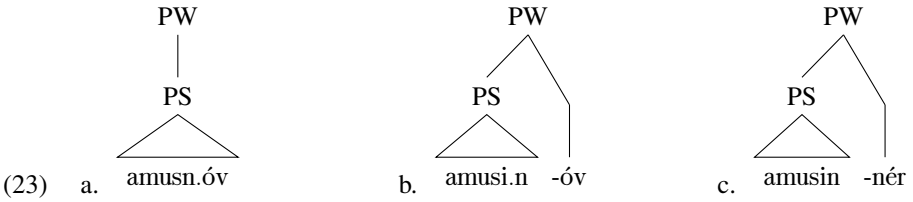
Table 3: Serial lexical-phonology spell-out for with prosodic constituents and misalignment.

At step (b), the root *amusin* is spelled-out and goes through the stem-level cophonology to get stressed. Here, the MStem maps onto a PStem. At step (c), the inflectional suffixes are spelled out and syllabified. The V-initial suffix *-ov* syllabifies with the stem, while the C-initial *-ner* does not.

For the V-initial suffix *-ov*, syllabification with the stem will form *(amusí.n)-ov*. This makes the PStem no longer aligned with syllable boundaries. At step (d), in the case of Eastern Armenian, this causes the PStem to expand, misalign with the MStem, and realign with the newly formed syllable boundary. This will form *(amusín-ov)* as an intermediate representation. This triggers an additional round of the stem-level cophonology of reduction at step (e) for Eastern Armenian to get *amusn-óv*. But for Western Armenian, aligning with the MStem boundary is ranked higher than aligning with the PStem boundary, thus there is no expansion or misalignment and we stick with *(amusí.n)$_s$-ov* as an intermediate representation. Because the C-initial suffix *-ner* doesn't syllabify with the stem, it creates no misalignment between the PStem and either the MStem or syllable boundaries. Thus, no expansion is needed and we stick with *(amusin.)$_s$-ner*.

The outputs are as expected at step (f,g) with the word-level phonology triggering final stress to get *amusn-óv*, *amusin-óv*, and *amusin-nér*. The final prosodic structures for the three words are represented in (23). Note the contrast between their prosodic constituents in (23) vs. their morphological constituents in (20). Specifically, note how in (20a) vs. (23a) we find the PStem and MStem to be non-isomorphic in Eastern Armenian because of V-initial inflection.

(23)



[9]For a formalization using Generalized Alignment (McCarthy and Prince 1993) for getting the PStem to differ across the two dialects, see Dolatian (in press.). The relevant constraints are ALIGN(PStem,R,σ,R) and ALIGN(PStem,R,MStem,R).

4 Discussion and Conclusion

This paper showed how two seemingly simple processes in Armenian, stress and vowel reduction, require nuanced interactions between morphological structure, morpho-phonological derivation, and phonological representations. Crucially, the data required a synthesis of the procedural approach of Lexical Phonology and the representation approach of Prosodic Phonology.

The cyclic behavior of vowel reduction necessitated multiple levels of derivation. In the case of word with multiple derivational suffixes like *d͡zən-ənt-ot͡s*, there were as many cycles as there were derivational affixes. This was formalized using Lexical Phonology's cyclic stem stratum, but comparable results can be gained with either Stratal OT or Output-Output constraints as long as multiple cycles are allowed (cf. Bermúdez-Otero 2011, 2012, 2018). The fact that there was as many cycles as derivational suffixes indicates that cyclicity in Armenian is potentially unbounded (cf. Orgun 1994). Armenian is thus one of the relatively few cases where phonological derivation cannot be boiled down into only two cycles (cf. Cole 1995).

The applicability of vowel reduction under stress shift showed an acute distinction between whether stress was lost to a derivational vs. inflectional suffix. In both dialects, derivational suffixes trigger destressed vowel reduction as in *amusín→amusn-agan* 'marriage'→'marital' (19b). However, in Western Armenian, we saw that inflectional suffixes like *-ov* (19d) or *-ner* (19e) could not trigger vowel reduction. This necessitates setting up two different phonological strata each with its own cophonology: a stem-level cophonology or stratum for derivation vs. a word-level cophonology or stratum for inflection. Stress assignment on the final syllable was active on both strata; whereas, reduction had to be active in the stem-level stratum but not in the word-level stratum.

In contrast, in Eastern Armenian, only V-initial inflection like *-ov* could trigger reduction (19c). This had a clear explanation in terms of syllabification and prosody. It specifically requires setting up sublexical prosodic constituents to match our sublexical strata, i.e., a prosodic stem. On the one hand, the PStem has to be mapped from morphological structure. Before V-initial inflection, the PStem would misalign from the MStem in Eastern Armenian because it prioritized aligning with the new syllable boundaries which V-initial inflection created. But on the other hand, the misalignment of a representational constituent like the PStem triggered an extra round of the stem-level cophonology of vowel reduction. This shows an intricate relationship between phonological representation and phonological procedure in that each affects the other and both are necessary (cf. Scheer 2011, 2012).

In sum, the sensitivity which stress and vowel reduction show to morphology, derivation, and representation is mitigated by multiple factors. The present paper showed what these factors were, both individually and when combined. Because of these interactions, Armenian provides a glance into better understanding the morphology-phonology interface.

References

Bermúdez-Otero, Ricardo. 2011. Cyclicity. In *The Blackwell companion to phonology*, ed. M. van Oostendorp, C. Ewen, E. Hume, and K. Rice, volume 4, 2019–2048. Malden, MA: Wiley-Blackwell.

Bermúdez-Otero, Ricardo. 2012. The architecture of grammar and the division of labour in exponence. In *The morphology and phonology of exponence*, ed. J. Trommer, number 41 in Oxford Studies in Theoretical Linguistics, 8–83. Oxford: Oxford University Press.

Bermúdez-Otero, Ricardo. 2018. Stratal phonology. In *The Routledge handbook of phonological theory*, ed. S.J. Hannahs and Anna R. K. Bosch, 100–134. Abingdon: Routledge.

Cole, Jennifer. 1995. Eliminating cyclicity as a source of complexity in processing phonology. In *Linguistics and Computation*, ed. J. Cole, G. M. Green, and J. L. Morgan, number 52 in CSLI Lecture Notes, 255–280. Stanford, CA: CSLI Publications.

Crosswhite, Katherine. 2001. *Vowel reduction in Optimality Theory*. Outstanding dissertations in linguistics. New York & London: Routledge.

DeLisi, Jessica L. 2015. Epenthesis and prosodic structure in Armenian: A diachronic account. Doctoral dissertation, University of California, Los Angeles, Los Angeles, CA.

Dolatian, Hossep. In press. Armenian prosody: a case for prosodic stems. In *Proceedings of the 53rd Annual Meeting of the Chicago Linguistics Society*.

Downing, Laura J. 1999. Prosodic stem ≠ prosodic word in Bantu. In *Studies on the phonological word*, ed. T. A. Hall and U. Kleinhenz, 73–98. Amsterdam: John Benjamins.

Downing, Laura J. 2016. The prosodic hierarchy in Chichewa: How many levels? *Studies in Prosodic Grammar* 1:5–33.

Halle, Morris, and Alec Marantz. 1993. Distributed morphology and the pieces of inflection. In *The view from Building 20: Studies in linguistics in honor of Sylvaln Bromberger*, ed. K. Hale and S. J. Keyser, 111–176. Cambridge, MA: MIT Press.

Inkelas, Sharon. 1989. Prosodic constituency in the lexicon. Doctoral dissertation, Stanford University, Stanford, California.

Inkelas, Sharon. 2014. *The interplay of morphology and phonology*. Oxford Surveys in Syntax & Morphology. Oxford: Oxford University Press.

Ito, Junko, and Armin Mester. 2009. The extended prosodic word. In *Phonological domains: universals and deviations*, ed. J. Grijzenhout and B. Kabak, volume 16, 135–194. Walter de Gruyter.

Kaisse, Ellen M. 1985. *Connected speech: the interaction of syntax and phonology*. Orlando:FL: Academic Press.

Khanjian, Hrayr. 2009. Stress dependent vowel reduction. In *Proceedings of the 35th Annual Meeting of the Berkeley Linguistics Society*, ed. I. Kwon, H. Pritchett, and J. Spence, 178–189. Berkeley, CA: Berkeley Linguistics Society.

Kiparsky, Paul. 1982. Lexical morphology and phonology. In *Linguistics in the morning calm: Selected papers from SICOL-1981*, ed. I.-S. Yang, 3–91. Seoul: Hansin.

Kiparsky, Paul. 2015. Stratal OT: A synopsis and FAQs. In *Capturing phonological shades within and across languages*, ed. Y. E. Hsiao and L. Wee, 2–44. Cambridge: Cambridge Scholars Publishing.

Mansfield, John. 2017. Prosodic words in cyclic derivation: the strange case of Murrinhpatha compound verbs. *Morphology* 27:359–382.

McCarthy, John J. 2003. Comparative markedness. *Theoretical linguistics* 29:1–51.

McCarthy, John J, and Alan Prince. 1993. Generalized alignment. In *Yearbook of morphology 1993*, ed. G. Booij and J. van Marie, 79–153. Dordrecht: Kluwer Academic Publishers.

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

Orgun, Cemil Orhan. 1994. Monotonic cyclicity. ROA-123, Rutgers Optimality Archive, http://roa.rutgers.edu/.

Scheer, Tobias. 2011. *A guide to morphosyntax-phonology interface theories: how extra-phonological information is treated in phonology since Trubetzkoy's Grenzsignale*. Berlin: Mouton de Gruyter.

Scheer, Tobias. 2012. Chunk definition in phonology: prosodic constituency vs. phase structure. In *Modules and interfaces*, ed. M. Bloch-Trojnar and A. Bloch-Rozmej, 221–253. Lublin: Wydawnictwo KUL.

Selkirk, Elisabeth. 1996. The prosodic structure of function words. In *Signal to syntax: Bootstrapping from speech to grammar in early acquisition*, ed. J. L. Morgan and K. Demuth, volume 187, 214. Mahwah, NJ: Lawrence Erlbaum Associates.

Selkirk, Elisabeth. 2011. The syntax-phonology interface. In *The Handbook of Phonological Theory*, ed. J. Goldsmith, J. Riggle, and A. Yu, 435–483. Oxford: Wiley-Blackwell, 2 edition.

Vaux, Bert. 1998. *The phonology of Armenian*. Oxford University Press, USA.

Vogel, Irene. 2008. The morphology-phonology interface: Isolating to polysynthetic languages. *Acta Linguistica Hungarica* 55:205–226.

Vogel, Irene. 2009. The status of the clitic group. In *Phonological domains: universals and deviations*, ed. J. Grijzenhout and B. Kabak, volume 16, 15–46. Walter de Gruyter.

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