Armenian stress: A case for (prosodic) stems
Hossep Dolatian
Stony Brook University

1 Introduction
Prosodic phonology argues that phonological processes apply within phonological
domains or constituents (P-constituents) which are derived from morpho-syntactic
structure (Nespor & Vogel 1986; Selkirk 2011). The traditional prosodic hierarchy
has the Prosodic Word (PWord)\(^1\) as the lowest morphologically-derived P-
constituent (Vogel 2008). Most mainstream approaches (Ito & Mester 2009; Selkirk
2011) argue that there are only three P-constituents: the prosodic word (PWord), the
prosodic phrase (PPhrase), and the intonational phrase (ip). This paper argues that
these three constituents are not enough.

We demonstrate on the basis of Armenian that an additional P-constituent which
is sublexical or below the PWord is needed, the prosodic stem (PStem)\(^2\). Although
the PStem’s existence is controversial (Vogel 2016), it has been argued to exist
in multiple agglutinative languages (Downing 2016) and data from Armenian will
show that the PStem is a required P-constituent and should be part of the Prosodic
Hierarchy.

Armenian is a primarily suffixing Indo-European language with agglutinative
nominal morphology. It has two dialect families, Western Armenian (WA) and Eastern
Armenian (EA), each with its own standard dialect. In this paper, we analyze
two prosodic processes across the two standard dialects,\(^3\) primary stress assign-
ment and destressed high vowel reduction, and describe the various phonological
and morphological factors which control these two processes. The data shows that
an adequate model that accounts for the domains of these two processes and for
their dialectal differences requires access to both the phonological word (PWord)
and the phonological stem (PStem).

This paper is structured as follows. We first provide basic descriptive data on
Armenian word-level prosody (§2). This includes both stress assignment (§2.1)
and vowel reduction (§2.2). Vowel reduction is quite complicated and is affected
by complex phonological (§2.2.1) and morphological factors (§2.2.2). We move on
to describe the prosodic domains for these two processes (§3). We crucially show
that the domain of vowel reduction cannot be either the PWord (§3.2) or a recursive

\(^1\)Throughout this paper, we will interchangeably use the terms prosodic word, phonological
word, PW, and PWord.

\(^2\)Throughout this paper, we will interchangeably use the terms prosodic stem, phonological stem,
PS, and PStem.

\(^3\)Western and Eastern Armenian are distinguished by a set of consonant shifts between them, e.g.
Western \(k^h\)irk\(^h\) vs. Eastern girk\(^h\) ‘book’. For reasons of space and readability, all consonants in the
examples are transcribed in the WA variant. We do not mark aspiration either. Aspiration and the
difference in consonants between the dialects does not affect stress or vowel reduction.
PWord (§3.3). Instead we show that domain of reduction must be the prosodic stem (§4) with illustrations and arguments for its use both outside of Armenian (§4.1) and within (§4.2). A typological discussion of the PStem as it operates within Armenian and outside of Armenian is in section §4.3. We conclude in section §5.

2 Data on word-level prosody

2.1 Primary Stress assignment

In both Standard Western and Eastern Armenian, primary stress falls on the right-most full vowel in the morphological word (MWord). A full vowel in Armenian is any vowel which is not a schwa (1a,1b,1c,1d). Schwas cannot be stressed (1e).

(1) a. kórdz  ‘work’
    b. kórdz-avór  ‘worker’
    c. kórdz-avor-nér  ‘workers’
    d. kórdz-avor-ner-óv  ‘with workers’
    e. kórdz-avor-ner-óv-ə  ‘with the workers’

Morphologically this stressed syllable can be either part of a root (1a), a derivational suffix (1b), or an inflectional suffix (1c,1d). However stress cannot fall outside the word and on enclitics (2).

(2) a. kórdz-avor-ner-óv  ‘with workers’
    b. kórdz-avor-ner-óv en  ‘(they) are with workers’

The (largest) domain of stress can be considered to be the phonological or prosodic word (PWord) (Vogel 2008; Nespor & Vogel 1986). Thus in Armenian, the morphological word is isomorphic with the phonological word because all suffixes can carry stress.

(3) PWord Isomorphism: MWord = PWord
The phonological word is isomorphic to the morphological word

For simplicity, all examples will consist of only one morphological word (MWord) and only one phonological word (PWord). PWord boundaries will not be given in the examples for readability.

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4Here, we will focus only on the word and not on nuances of clitic behavior. We are neutral as to whether clitics are prosodified as part of a phonological phrase (as in the above figure) (Selkirk 1996), or the Clitic/Composite Group (Vogel 2009; Vogel 2016), or a recursive maximal PWord (Ito & Mester 2009), either of which must be stipulated as not triggering stress shift. More information on clitic behavior can be found in Khanjian (2013).
2.2 Vowel reduction

In both the Western and Eastern dialects, there is evidence that stress is being assigned and reassigned as each suffix is added. The evidence is the reduction of destressed high vowels (Vaux 1998; Dum-Tragut 2009; Khanjian 2009) to either a schwa (4) or nothing (5).

(4) a. hín ‘old’
    b. hon-utjún ‘oldness’

(5) a. teğín ‘yellow’
    b. teğn-orág ‘yellowish’

Vowel reduction heavily interacts with both phonological structure and morphological structure. We discuss the phonological factors first in §2.2.1 and then the morphological factors in §2.2.2.

2.2.1 The phonology of vowel reduction

The phonological factors that affect vowel reduction are few but systematic. First, only a destressed vowel may reduce, not an unstressed vowel. A destressed vowel is a vowel which was stressed in a previous cycle but lost stress in subsequent cycles (6). Unstressed vowels which had never received stress in previous cycles do not reduce, e.g. we can’t reduce the second /i/ in /irigún-anál/ to *[irgun-anál] because it was not previously stressed.

(6) a. irigún ‘evening’
    b. irig-anánal *[irgun-anál] ‘to become evening’

Second, among monophthongs, only high vowels can reduce (7,8). Non-high monophthongs don’t reduce (9,10,11).

(7) a. makúr ‘clean (adj)’
    b. makr-utjún ‘cleanliness’

(8) a. pağín ‘section’

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5We explain when you get the different options for reduction (delete vs. schwa) in the next section.

6A closed class of roots where the rightmost vowel is /e/ exceptionally reduce under stress shift: sér → sir-él ‘love’ → ‘to love’ vs. sér → ser-él ‘gender’ → ‘to generate’. These cases are due to a mix of diachronic and sublexical factors which are beyond the scope of this paper.
b. paẓn-utjún ‘separation’

(9) a. uráx ‘happy’
b. urax-utjún *urx-utjún ‘happiness’

(10) a. kiʃér ‘night’
b. kiʃer-aj́in *kiʃr-aj́in ‘nocturnal’

(11) a. 50yóv ‘meeting, assembly’
b. 50yov-agán *50yv-agán ‘collective (adj)’

Furthermore the high diphthong [ui] can also be reduced under stress shift, but only to [u] (12).  

(12) a. kújn ‘color’
b. kun-av́or *kn-av́or ‘colorful’

A vowel that satisfies all the above conditions (i.e. a destressed high vowel) will reduce. Reduction will typically manifest as vowel deletion (e.g. (13) and all the above examples), unless deletion would create a complex onset 8. In that case, the vowel instead reduces to a schwa (14) 9.

(13) a. amusín ‘husband’
b. amusn-utjún *amusn-utjún ‘marriage’

(14) a. azńiv ‘honest’
b. azn̩ov-utjún *aznv-utjún ‘honesty’

Like stress assignment, reduction also applies cyclically as shown by sequences of multiple destressed high vowels (15,16). This is a case of unbounded cyclicity (Orgun 1994).

(15) a. ðźin ‘birth (esp. of animals)’
b. ðz̩n-únt ‘birth’
c. ðz̩n-ɔnt-agán ‘generative’

(16) a. lújs ‘light’
b. lus-av́or ‘luminous’
c. lus-avor-itʃ ‘illuminator’
d. lus-avor-ʃ'-agan ‘Apostolicism’

7The other diphthongs in Armenian do not systematically reduce. These include /ju/, /jo/, /ja/, /je/, /æj/. For some speakers, the diphthong /ju/ is in free variation with /y/ but still does not reduce. See Khanjian (2009) for discussion.

8The only permissible complex onset in Armenian is a Cj or consonant-glide sequence like [kjuʃ] ‘village’ (Vaux 1998:23). Though the glides in these sequences can be argued to form a rising diphthong with the nucleus and thus not be part of a complex onset.

9Vaux (1998) and Khanjian (2009) argue that vowel reduction is actually a process of deletion + schwa epenthesis because of how Armenian has a general process of schwa insertion to break clusters. Whether we break up reduction into two processes or keep it as one process is a conceptual issue which is beyond the scope of this paper.
However for reasons of simplicity and space limitations, we will not discuss the cyclic application of vowel reduction because that requires a stratal or lexical phonological augmentation to the present study. We leave this for future work.

To summarize, a vowel must reduce if:

(17) **General phonological factors:**

1. the vowel is de-stressed
2. the vowel is a high vowel /u, i/ or a high diphthong /uj/

This reduced vowel will preferably delete, unless deletion would create a complex onset. In that case, it would reduce to a schwa.

For reasons of space, we do not formalize the above guidelines into optimality-theoretic constraints. The interested reader may see Khanjian (2009) who provides an OT-treatment for stress assignment and for the phonological factors of reduction.

### 2.2.2 The morphology of vowel reduction

In both Western and Eastern Armenian, vowel reduction has the same phonological conditions (17), but there is dialectal variation in the morphological contexts which trigger or block vowel reduction.

In both dialects, derivational suffixes trigger stress shift and destressed high vowel reduction (18a). However the situation is more complicated with inflectional suffixes and this is where we find both dialectal variation and reference to different prosodic domains. Inflectional suffixes trigger stress shift in both dialects. However in Western Armenian (WA), inflectional suffixes do not trigger vowel reduction (18b,18c). In contrast, Eastern Armenian (EA) has vowel reduction before vowel-initial (V-initial) inflectional suffixes (18d), but not before consonant-initial (C-initial) (18b).

(18) a. animın → animın-agän 'husband' → 'marital' (WA & EA)
   b. animın → animın-nér 'husband' → 'husband-PL' (WA & EA)
   c. animın → animın-ı 'husband' → 'husband-DAT' (WA)
   d. animın → animın-ı 'husband' → 'husband-DAT' (EA)

The inability of inflectional suffixes to trigger vowel reduction is relatively systematic in WA. Some exceptional stems reduce before some V-initial inflectional suffixes which do not contain a full vowel and thus do not take on stress:

- Definite ә after C-final bases, Definite n after V-final bases, possessor suffixes -(ә)s (1SG Poss) or -(ә)t (2SG Poss) where the schwa is dropped after V-final bases.

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10The relevant inflectional suffixes are plural markers er/ner and case markers: Dative/Genitive -i/-u, Ablative -i/its, Instrumental -ov, and (only in EA) Locative -um. For the plural suffix, -er and -ner are phonologically conditioned allomorphs: -er after monosyllabic bases, -ner after polysyllabic bases. Dative/Genitive -i/-u are morphologically conditioned allomorphs (at least in WA): -i after singular bases, -u after polysyllabic bases. Ablative -e/its, are dialectally different: -e in WA, -i/its in EA. Note that the only C-initial suffix is the plural allomorph -ner. It doesn’t trigger vowel reduction in WA or EA. But the other plural allomorph -er is V-initial but triggers reduction in EA. Because they are phonologically-conditioned allomorphs of the plural, their difference in behavior with reduction thus must be due to their phonological structure and not their morphosyntactic structure. I put aside inflectional suffixes which do not contain a full vowel and thus do not take on stress: Definite ә after C-final bases, Definite n after V-final bases, possessor suffixes -(ә)s (1SG Poss) or -(ә)t (2SG Poss) where the schwa is dropped after V-final bases.
suffixes (19b), but not before all V-initial inflectional suffixes (19c). Even for these exceptional stems, C-initial inflection still doesn’t trigger reduction in WA (19d). However, the general pattern for Western Armenian is to not reduce under inflection.

(19) a. jerg´ir ‘country’
   b. jergiri-’i ? jergir-í ‘country-DAT’
   c. jergir-óv ? jerg-r-óv ‘country-INSTR’
   d. jergir-n´er *jergir-nér ‘country-PL’

Similarly for Eastern Armenian, the general pattern is for V-initial inflection to trigger vowel reduction. But some exceptional stems tend to resist inflection (Dum-Tragut 2009). We leave a systematic study of such exceptions for future work.

To summarize, stress shift is systematically triggered by all suffixes in both dialects. But the same cannot be said for reduction. Setting aside exceptions, the general morpho-phonological factors which interact with reduction in both dialects are summarized in Table (1).

<table>
<thead>
<tr>
<th>Dialect</th>
<th>Derivation</th>
<th>Inflection (V-initial)</th>
<th>Inflection (C-initial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>EA</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
</tbody>
</table>

**Table 1:** Summary of morphological factors of vowel reduction in Western (WA) and Eastern Armenian (EA).

The next section provides a model for the stress and reduction patterns in the framework of prosodic phonology.

### 3 Prosodic Domains

As a model of the morphology-phonology interface, prosodic phonology (Nespor & Vogel 1986; Selkirk 2011) argues that phonological processes apply within phonological domains or phonological constituents (P-constituents). This is especially the case when these P-constituents are influenced by morpho-syntactic structure or by morpho-syntactic constituents (M-constituents) but do not perfectly line up or match with these M-constituents. Because both stress and stress-based processes (i.e. destressed vowel reduction) are prosodic processes, the question is then: what are the prosodic domains for stress assignment and destressed vowel reduction?

Because of space limitations, the analysis below assumes a fully constructed morphological word. We analyze what the prosodic domains for stress and reduction are after all morphemes have been combined. A more complete picture will require incorporating some interaction or interleaving of morphology and phonology (i.e. lexical phonology (Kiparsky 1982; Bermúdez-Otero 2016)) in order to capture the cyclic effects. But we leave that for future work. For the time being, we focus on providing just the final prosodic domains for stress and vowel reduction.
3.1 Domains at a glance
As discussed in section §2.1, the final location of stress after all suffixes have been added is always the rightmost full vowel. Within prosodic phonology, this can be understood as the stressed vowel being the rightmost full vowel in the phonological word.

The behavior and domain of vowel reduction are more complicated. In both dialects, the domain for vowel reduction includes derivational suffixes. However, in one dialect (Western Armenian), this domain excludes all inflectional suffixes; while in another dialect (Eastern Armenian), this domain includes V-initial inflectional suffixes but excludes C-initial inflectional suffixes. This was schematized in Table (1). Reduction applies if both the newly stressed vowel and the destressed vowel are within the same domain.

Our proposal is that the final domain for stress assignment is the phonological or prosodic word (PWord) while that of destressed vowel reduction is the phonological or prosodic stem (PStem) (Downing 1999a). Before showing how we use the PStem to account for reduction, we show how alternative P-constituents (PWords or recursive PWords) are not viable domains for reduction.

3.2 Reduction in the PWord?
Focusing on Western Armenian, we notice that there is a clear derivational-vs.-inflectional split: derivation triggers stress shift and reduction, inflection triggers only stress shift.

(20) a. kórdz ‘work’
b. kórdz-itʃ ‘agent’
c. kórdz-itʃ-i ‘agent-DAT’ (WA)
d. * kórdz-tʃ-i ‘agent-DAT’ (ungrammatical for WA)

One approach would be to argue that the domain for both reduction and stress is the prosodic word (PWord). However, stress and reduction provide two contradictory definitions or mapping rules for the PWord in WA. In WA, the domain of stress includes the root, derivational suffixes and inflectional suffixes; while the domain of reduction in WA excludes inflectional suffixes. If the PWord were to be made the domain for both stress and reduction, then we would incorrectly predict that inflection triggers reduction in WA (20d). We visualize these two contradictory definitions for the PWord in Figure (2).

Clearly, the domains of stress and vowel reduction cannot be the same constituent or the same PWord as shown in Figure (2). Simply put, it’s because these two domains don’t include the same morphemes.

3.3 Recursive PWOrds?
The problem of having the same constituent be the domain for both stress and reduction could be avoided through using recursive phonological constituents, specifically recursive PWOrds (Ito & Mester 2009). Utilizing recursion, we could define
Figure 2: Contradictory definitions of the phonological word for stress and reduction

Although the use of these two versions of PWords can provide us one domain for stress and one domain for reduction, it comes at a conceptual cost: we lose a concrete definition of constituents. If two structures are the same constituent and have the same name, then they should have the same behaviors and properties (Vogel 2009; Vogel 2012; Vogel 2016). Putting this into our Armenian context, what we are calling two prosodic words (PW and PW') do not act the same: one defines stress and includes inflection, another defines reduction and doesn’t include inflection. Even though these two layers of structure have same name, they do not act like the same constituent. If these two layers of structure were to be the same constituent then they would share all phonological properties: they should both trigger stress and reduction.

The addition of the adjective "recursive" to "recursive PWord" or the diacritic symbol ' to PW' creates the implication that these two layers of structure should be the same thing yet they are not. However for all intents and purposes, we could might as well label our lower prosodic structure as the phonological X (PX) while the upper structure as phonological Y (PY). We could define PX as being the domain of reduction, while PY the domain of stress. Doing so would increase the number of levels in the prosodic hierarchy but it would not weaken the definition of constituency and the categorization of structures into constituents. We take up this
alternative strategy in the next section.

4 Prosodic Stems
In prosodic phonology, the phonological word (PWord) is considered to be the phonological counterpart of the morphological word (MWord) (Nespor 1999; Hall & Kleinhenz 1999; Selkirk 1986; Selkirk 1996; Selkirk 2011). As such, MWords are argued to map to PWords so that various prosodic processes may apply within them. The derived PWords do not need to structurally match their base MWords, i.e. a PWord may contain more/fewer segments or morphemes than the MWord. Such cases of non-isomorphism have been used as arguments for letting PWords be both derived and independent from MWords.

Besides the PWord, other commonly used and agreed upon prosodic constituents are the prosodic phrase (PPh) and intonational phrase (IP); the former is mapped from syntactic phrases (XPs) while the latter from syntactic clauses (CPs). Besides these three basic P-constituents (PWord, PPh, IP), some have argued for more prosodic constituents (Hall 1999). One set of proposed P-constituents are the Prosodic Root (PRoot) and Prosodic Stem (PStem) which are mapped from morphological roots (MRoot) and morphological stems (MStem) (Inkelas 1989; Fitzpatrick-Cole 1994; Downing 1999a). These two P-constituents act as sublexical prosodic constituents because they correspond to morphosyntactic levels below the (lexical) word and are dominated by the PWord.

In this paper, we argue that the relevant prosodic domain for vowel reduction is distinct from the prosodic domain of stress. Specifically, we argue that vowel reduction applies within the Prosodic Stem (Downing 1999a) while final stress appears within the Prosodic Word (PWord). Because the PStem is a controversial prosodic constituent, we first discuss how (and why) the PStem has been used to model prosodic processes in other languages (§4.1). We then show how we use it to model vowel reduction in Armenian (§4.2). We discuss how the Armenian PStem relates to the larger typology of PStems in section §4.3.

4.1 PStems outside of Armenian
The strongest cases for the existence of the PStem have come from highly agglutinative languages, especially Bantu languages (Downing 1998; Downing 1999a; Downing 1999b; Downing 2000; Downing 2006; Downing & Kadenge 2015; Hyman 2009), with other cases springing from similar agglutinative non-Bantu languages (Inkelas & Zoll 2005; Downing 2016). To illustrate, we show how the PStem has been used to model reduplication in the KiHehe verb (Odden & Odden 1985; Aronoff 1988) which shows PStem-MStem mismatches similar to those in Armenian (Downing 1998).

In KiHehe, a verb’s morphological stem (MStem) consists of a root and all derivational suffixes while it excludes inflectional prefixes\(^{11}\). Total reduplication

\(^{11}\)These derivational suffix are traditionally called *extensions* and consist of valency-changing suffixes (passivization, causativization, reciprocalization). The MStem in KiHehe also includes an inflectional final vowel (IFV) suffix which comes after the derivational suffixes. This IFV is either a dummy morpheme or a tense morpheme. The data presentation and analysis is a simplified version
is used to mark frequentative meaning or ‘to do X a little bit’ (Hyman 2009). When reduplication is applied to a word consisting of an inflectional prefix and a C-initial stem, it is only the stem that reduplicates without the inflectional prefix (21). However when the stem is V-initial, the reduplicant consist of the MStem and the rightmost consonant of the inflectional prefix (22c). In the examples, we mark the MStem in bold and mark the reduplicant with italics.

(21) a. ku-haata ‘to ferment’
    b. ku-haata~haata ‘to start fermenting’
    c. *ku-haata~ku-haata ‘to start fermenting’

(22) a. kw-iita ‘to pour’
    b. *kw-iita~iita ‘to start pouring’
    c. kw-iita~kw-iita ‘to start pouring’

In order to capture this difference between C-initial vs. V-initial stems, Downing (1998) argues that the target of reduplication isn’t the morphological stem but the prosodic stem. This prosodic stem is derived from the MStem but will misalign from it in order to respect syllabification and prosodic well-formedness. We reproduce the examples above and add the PStem. We mark the PStem by underlining it.

(23) a. ku-haata ‘to ferment’ (PS=MS)
    b. ku-haata~haata ‘to start fermenting’ (RED=PS=MS)
    c. *ku-haata~ku-haata ‘to start fermenting’ (RED>PS,MS)

(24) a. kw-iita ‘to pour’ (PS>MS)
    b. *kw-iita~iita ‘to start pouring’ (RED=MS)
    c. kw-iita~kw-iita ‘to start pouring’ (RED=PS)

In the case where the MStem begins with a consonant, the MStem will begin with a syllable boundary. This means that the MStem and PStem will match and be isomorphic (23a). Reduplication will then copy the PStem which is segmentally identical to the MStem (23b). But when the MStem starts with a vowel, this vowel will syllabify with the rightmost consonant of the inflectional prefix. In this case, the PStem will respect syllable boundaries and will be larger than the the MStem because it includes the prefix’s consonant (24a). Reduplication will then copy the PStem (24c).

We extend a similar analysis to Armenian in the next section.

4.2 PStems in Armenian

Like KiHehe reduplication, Armenian vowel reduction shows sensitivity to both derivation vs. inflection and C-initial vs. V-initial morphemes. We reproduce examples from (18) below.

(25) a. amus´in → amusn-aq´an ‘husband’ → ‘marital’ (WA & EA)

b. amusín → amusín-nér ‘husband’ → ‘husband-PL’ (WA & EA)
c. amusín → amusín-í ‘husband’ → ‘husband-DAT’ (WA)
d. amusín → amusn-í ‘husband’ → ‘husband-DAT’ (EA)

We argue that the morphological stem (MStem) in Armenian consists of a root and all derivational suffixes but excludes inflectional suffixes. This MStem maps to a prosodic stem (PStem). We show that vowel reduction applies when a PStem-internal destressed high vowel lost stress to another PStem-internal destressed high vowel. We formalize this with the below alignment constraints:

(26) ALIGN-(PS,R,MS,R) or ALIGN-PS-MS
The right edge of the PStem aligns with the right edge of the MStem

(27) ALIGN-(PS,R,σ,R) or ALIGN-PS-σ
The right edge of the PStem aligns with the right edge of a syllable

(28) DEP-PS-MS
Every element of the PStem has a correspondent in the MStem

(29) MAX-PS-MS
Every element of the MStem has a correspondent in the PStem

In both EA and WA, the PStem is never smaller than the MStem. Every segment in the MStem gets included in the PStem. We can model this with MAX-PS-MS outranking DEP-PS-MS in both dialects. We can treat this fixed ranking as part of a master ranking for both dialects (Anttila 2002). In the case of ALIGN-PS-MS and ALIGN-PS-σ, we will for now assume that these two constraints are unranked in the master ranking, but they will have a specified ranking in each dialect in order to capture dialect variation on PStem formation and reduction.

First in the case of words with derivational suffixes but without inflection (25a), the derivational suffix is part of the MStem and triggers reduction in both dialects. This means that the derivational suffix is also part of the PStem, making the PStem be isomorphic with the MStem in both dialects.

We formalize this with tableau (30). Constraints for stress assignment, stress shift, and vowel reduction are assumed. We mark the right edge of the MStem with the symbol } (in the input), and we mark the right edge of the PStem with the symbol > (in the output). To reduce clutter, we do not show the MStem boundary in the output candidates, only in the input. Note how derivational suffixes don’t require a specific ranking between ALIGN-PS-MS and ALIGN-PS-σ.

(30) Armenian (both Western and Eastern)

<table>
<thead>
<tr>
<th>amusín-aqan{</th>
<th>ALIGN-PS-MS, ALIGN-PS-σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. amusi.&gt;nagán</td>
<td>*!</td>
</tr>
<tr>
<td>b. a amusnaqan&gt;</td>
<td></td>
</tr>
</tbody>
</table>

In the case of words with C-initial inflectional suffixes (25b), the C-initial inflectional suffix is outside the MStem and doesn’t trigger reduction in either dialect. This means it is not part of the PStem, making the PStem be isomorphic with the MStem in both EA and WA. Again, no ordering is needed between the two constraints so far (31).
But in the case of words with V-initial inflectional suffixes, the dialects start behaving differently. In WA, V-initial inflection is outside the MStem and doesn’t cause reduction (25c). This means it’s outside the PStem making the PStem stay isomorphic with the MStem. The PStem prefers to stay aligned with the MStem rather than with the new syllable boundaries resulting from V-initial inflection. This requires us to have ALIGN-PS-MS outrank ALIGN-PS-σ in WA (32).

In Eastern Armenian, the situation is reversed. V-initial inflectional suffixes are outside the MStem but they trigger vowel reduction (25d). This means that the PStem becomes non-isomorphic with the MStem. Here, the PStem prefers to stay aligned with the new syllable boundaries resulting from V-initial inflection rather than with the MStem. In EA, the PStem and MStem are thus misaligned and V-initial inflection triggers vowel reduction. This requires us to have ALIGN-PS-σ outrank ALIGN-PS-MS in EA (33), which is the reverse ranking for WA (33).

4.3 PStems in and outside of Armenian

Cross-linguistically, the phonology-morphology interface is rife with examples of interaction between the two modules (Inkelas 1989; Inkelas 2014). In response to this, many theoretical models have been proposed to handle the interface including prosodic phonology (Nespor & Vogel 1986) and its variations and expansions (Inkelas 1989; Inkelas 1993; McCarthy & Prince 1993b; McCarthy & Prince 1993a; Selkirk 1996; Selkirk 2011; Downing 2006).

The basic concept behind prosodic phonology is the idea that phonological processes apply within phonological constituents (P-constituents) which are derived from morphological constituents (M-constituents). These P-constituents may become non-identical to their M-constituent counterparts because of prosodic well-formedness. Evidence for such non-isomorphism or misalignment are cases when the phonological process applies within a domain which doesn’t match any M-constituent but matches a prosodically well-formed P-constituent. Examples of
phonological processes applying in non-isomorphic P-constituents include well-known cases such as compound prosody (Vogel 2010), English stress assignment (Inkelas 1989), Bantu reduplication (Downing 1999a), and now Armenian vowel reduction.

But like with any theory, there are some issues in prosodic phonology which are controversial (Hall 1999; Trommer 2011; Hildebrandt 2015). As discussed in our introduction, one of these is the question: What are the universally possible or universally available P-constituents? The traditional assumption of prosodic structures (PW, PPh, ip) have been questioned by data which shows the need to have more than just three layers of structure. In response to this data, some have argued that P-constituents can be recursive (Selkirk 2011; Ito & Mester 2009) though this causes some problems (Vogel 2012; Vogel 2016). Others have argued for adding more P-constituents to model prosodic processes that are occurring above the word level (Kabak & Vogel 2001; Vogel 2009) or below the word level (Inkelas 1989; Downing 1999a). We have shown how Armenian provides evidence for the existence of at least one sublexical P-constituent, the prosodic stem or PStem.

But like adding any other theoretical tool, adding an additional P-constituent into the prosodic hierarchy thus raises the question: How does this PStem behave universally across languages? (Downing 2016) showed that the PStem has a similar set of behaviors across a variety of languages. We discuss and add to that set of behaviors in this section.

First, the most convincing cases for the PStem come from agglutinative languages where the morphological structure is complex enough to trigger subtle interactions with prosodic processes. Examples include agglutinative languages from multiple different languages and language families such as Salishan, Bantu, Indo-Aryan (Bengali) (Downing 2016), and now Armenian.

Second, the PStem shows sensitivities to differences between derivational vs. inflectional morphology (Trommer 2011). Since PStems are mapped from morphological stems which themselves are sensitive to derivational vs. inflectional morphology, it is not surprising that this sensitivity is carried over to PStems and becomes significant for morpho-phonological processes.

Finally, as a prosodic constituent, we expect that phonological well-formedness can trigger misalignment between the PStem and MStem both within a language or across different dialects (Downing 1998). This shows that the PStem, as a P-constituent, is independent from its morpho-syntactic origins. This means that phonological processes apply within prosodic domains that indirectly reference morpho-syntactic structure, contrary to theories of Direct Reference (Samuels 2011).

5 Conclusion
To summarize, Armenian has two productive word-level prosodic processes: primary stress assignment and destressed high vowel reduction. We described the phonological and morphological factors which trigger or block both processes. Crucially, these two processes do not apply within the same domain. Using (sublexical) prosodic phonology, we have shown that the domain of stress assignment is the prosodic word which includes the entire morphological word (root, derivation, and inflection). In contrast, vowel reduction operates within the prosodic stem.
In Western Armenian, the PStem perfectly matches the morphological stem; it includes only the root and derivational suffixes. But in Eastern Armenian, the PStem includes the root, derivational suffixes, and vowel-initial inflectional suffixes. We modeled this dialectal variation using different rankings of alignment constraints across the two dialects.

The Armenian data provides further evidence for the existence of the PStem, for its utility, and for its inclusion in the prosodic hierarchy. The Armenian data likewise gives support for the PStem’s typological properties as found in other agglutinative languages. Future work will provide a fuller analysis of reduction in Armenian where we will augment our prosodic model with a cyclic mechanism (Kiparsky 1982; Kiparsky 2000; Bermúdez-Otero 2012; Bermúdez-Otero 2016) to model the multiple applications of vowel reduction and stress assignment within sequences of multiple derivational suffixes, prefixes, and compounds. We likewise have sidestepped issues with lexical exceptions, abstract vowels, and root faithfulness in reduction. All of this issues are open to future work.

References


Bermúdez-Otero, R. 2012. The architecture of grammar and the division of labour in exponence. The morphology and phonology of exponence 41.8–83.


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Inkelas, S. *Prosodic constituency in the lexicon*. Stanford University Stanford, California dissertation.


Khanjian, H. (Negative) concord and head directionality in Western Armenian. Massachusetts Institute of Technology dissertation.


Trommer, J. 2011. Phonological sensitivity to morphological structure. in van oostendorp, m., ewen, cj, and rice, kd, editors. The Blackwell Companion to Phonology.


