Cyclic residues of affix deletion in Armenian passive stems

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Abstract

Morphophonological derivations are often simultaneously isomorphic to both surface morphotactics, cyclic phonology, and to abstract morphosemantic structure. On the surface, passive verbs in Armenian violate this isomorphism. Verbs consist of a bound stem plus suffixes. Passive stems are pre-consonantal and seem morphologically derived from roots, but their phonological structure is only predictable from the pre-vocalic stem of active verbs. I capture this predictability by combining cyclicity with affix truncation (Aronoff 1976). The interaction between cyclicity and affix deletion causes the opaque overapplication of phonological rules in passives, because such rules applied cyclically early in the active verb. This approach is a cyclic alternative to using Output-Output constraints. However, our cyclic analysis likewise predicts *ABA effects in the morphosemantics of passives, among other non-phonological dependencies. Thus, our analysis creates a cyclic dependency between two bound stems that is visible across grammatical modules.

1 Introduction

When determining the morphological structure of a word, we often rely on the linear order of overt morphs (Baker 1985). However, Armenian passive verbs are a case where the linear order of *overt* morphs contradicts the phonological derivation of words. In terms of surface morphs, passive verbs consist of a stem and then a consonantal suffix [-v-]. But there is extensive morphophonological evidence that passive verbs are phonologically

derived *as if* the passive stem precedes a vowel. I argue that this is because the pre-consonantal passive stem is cyclically derived from the pre-vocalic active stem. The end result is a cyclic dependency between two bound stems.[1]

Armenian is an independent branch in Indo-European with two standard lects: Western and Eastern Armenian.[2] This paper focuses on Western Armenian with some discussion of dialectal variation. For regular simple verbs, the active is formed by a root, theme vowel, and infinitive. The passive is canonically formed by placing the passive suffix *-v-* directly after the root. The passive then takes the *-i-* theme vowel (1a). I underline the stems.[3]

(1) *Overview of the data*

a. *Passivization*

tʰɑs	'class'
tʰɑs-e-l	'to classify'
tʰɑs-v-i-l	'to be classified'

b. *Glide epenthesis*

d͡zɑɾɑ	'servant'	√
d͡zɑɾɑj-e-l	'to serve'	√-TH-INF
d͡zɑɾɑj-v-i-l	'to be served'	√-PASS-TH-INF
*d͡zɑɾɑ-v-i-l		

Passivization interacts with multiple phonological processes within an opaque system. One such process is glide epenthesis (1b). In the active, vowel hiatus between the root and theme vowel is repaired by glide epenthesis, as in /d͡zɑɾɑ-e-l/ → [d͡zɑɾɑj-e-l] . But in the passive [d͡zɑɾɑj-v-i-l], there is no vowel hiatus between the root and passive suffix /-v-/, yet we still find glide epenthesis. Thus, glide epenthesis applies transparently in actives, and opaquely overapplies in passives.

The interaction between passivization and phonology is opaque if we derive passives from roots. In order to generate the right outputs, I argue that the passive stem must be derived from the active stem, and not the root. For example, the input to the passive verb [d͡zɑɾɑj-v-i-l] is the active stem [d͡zɑɾɑj-] and not the root [d͡zɑɾɑ]. I derive the data by combining cyclicity with affix truncation (Aronoff 1976). Cross-modular evidence from semantics and morphotactics provide independent evidence for a cyclic analysis over alternatives, summarized in Table 2 in §7.

This paper is structured as follows. §2 goes through our first opaque phonological process (glide epenthesis), and I formalize this opacity with phonological cyclicity and affix

[1]My gratitude (in chronological order) to to Mark Aronoff, Christina Bethin, Jeffrey Heinz, Donca Steriade, Ricardo Bermúdes-Otero, the editor (Michael Kenstowicz), and the audience of the Princeton Phonology Forum (and its organizers Laura Kalin and Florian Lionnet).

[2]Data is taken from philological works in the bibliography, my native Western Armenian judgments, and then checked against dictionary entries in Kouyoumdjian (1970) and Wiktionary. Leipzig glosses are used with the following additional glosses: TH (theme vowel), LV (linking vowel), AOR (aorist), INCH (inchoative), PTCP (participle), SPTPC (subject participle). The symbol √ is used to represent roots.

[3]I use the word 'stem' in a pre-theoretical sense. The stem for our purposes is the altered shape of the root when it precedes inflectional material such as the passive suffix or theme vowels.

truncation. §3 provides independent semantic and morphotactic evidence for the cyclic dependence of passives on actives. More phonological opacity is found in other phonological rules (§4) that again show this passive-active dependence. I qualify this dependency in §5 because of allomorphy in passives. Alternative treatments are discussed (§6). Conclusions are in §7.

2 Structure and cyclicity of the passive

I first review the basic morphological structure of active and passive verbs (§2.1). I then discuss the glide epenthesis data to show that the phonological base of passive stems is the active stem (§2.2). To create such inputs for the Phonology, I combine cyclicity with affix truncation in the Morphology (§2.3).

2.1 Overview of verb conjugation classes and passivization

Armenian verbs are grouped into three major categories: regular simplex verbs, regular complex verbs, and irregular verbs. Each category then has its own conjugation classes. Among all these types of verbs, the default verb class is the simplex E-Class. I focus first on simplex verbs and then discuss the other categories (§5).

In citation form, simplex verbs consist of a root, theme vowel /e,ɑ,i/, and infinitive suffix *-l* (2). Such verbs are active verbs. Some but not all of these verbs are derived from free-standing roots. Bound roots are in italics. Some verbs are transitive, while some are intransitive. Transitives are passivized by adding the passive suffix *-v-* after either the root (for the E/I-Class) or the aorist stem (for the A-Class). The passive suffix takes its own theme vowel *-i-*.

(2) *Active and passive verbs*

	Non-verbal root		Active verb		Passivized verb	
E-Class	tʰɑs	‘class’	tʰɑs-e-l	‘to classify’	tʰɑs-v-i-l	‘to be classified’
	kʰeɾ-		kʰeɾ-e-l	‘to scratch’	kʰeɾ-v-i-l	‘to be scratched’
	t͡sʏn	‘snow’	t͡sʏn-e-l	‘to snow’		
I-Class	*χos-*		χos-i-l	‘to speak’	χos-v-i-l	‘to be spoken’
	məs-		məs-i-l	‘to feel cold’		
A-Class	*gaɾtʰ-*		gaɾtʰ-ɑ-l	‘to read’	gaɾtʰ-ɑ-t͡s-v-i-l	‘to be read’
	tʰoʁ	‘tremble’	tʰoʁ-ɑ-l	‘to tremble’		
	√		√-TH-INF		√-(TH-AOR)-PASS-TH-INF	

For active verbs, the theme vowel is a meaningless suffix. It does not mark any semantic feature. For example, all three verb classes in (2) have transitive and intransitive members

(Guekguezian & Dolatian forthcoming). Within the Distributed Morphology framework (Halle & Marantz 1993; Embick & Noyer 2007), I follow Dolatian & Guekguezian (2022b) and treat this theme vowel as an adjunct to a covert VOICE head or little *v* head, similar to work on Romance verbs (Oltra-Massuet 1999). I provide tree structures later in §2.3.

As for passivization, the post-root theme vowel is deleted for some classes (E/I-Class) but not others (A-Class). For the A-Class, the theme vowel is kept and a meaningless morph *-t͡s-* intervenes between the theme vowel and the passive (see discussion of aorist stems in Dolatian & Guekguezian 2022a). I focus on the simpler case of E/I-Class passives, and I postpone A-Class passives till §3.3.

2.2 Phonological base for passivization

Given this basic catalog of passive verbs, I now focus on the morphological derivation of passives. Given an active verb /tʰɑs-e-l/ 'to classify' and its passive counterpart /tʰɑs-v-i-l/ 'to be classified', there are two possibilities for deriving these verbs from the root /tʰɑs/ 'class' (3).

(3) *Hypothetical derivations for the passive of an E-Class verb*

Root-derived	**Active-derived**
Verbs from the root /tʰɑs/ tʰɑs ↙ ↘ tʰɑs-e-l tʰɑs-v-i-l	Active from the root /tʰɑs/, Passive from the active stem /tʰɑs-/ tʰɑs ↓ tʰɑs-e-l ↓ tʰɑs-v-i-l

One option is the root-derived analysis, while the other is the active-derived analysis. For the root-derived analysis, the same morpheme /tʰɑs/ is the input to morphologically derive both the active and the passive. For the active-derived analysis, the morpheme /tʰɑs/ is the input to forming the active /tʰɑs-e-l/. To form the passive, we have to extract or reference the root from this pre-theme vowel position.

Viewed from the surface, the most obvious analysis is the root-derived analysis. For some verbs like 'to be classified', the root morpheme is homophonous across the free-standing form /tʰɑs/, the active verb /tʰɑs-/, and the passive verb /tʰɑs-/. For such verbs, there is thus no obvious reason to argue for a more articulated derivation. However, there is evidence for the more abstract derivation from other verbs. There are verbs whose root changes its shape across the nonverbal and verbal forms for phonological reasons. Here, we find that the passive verb seems to reference the active stem.

Consider glide epenthesis. Throughout Armenian, vowel-vowel sequences are repaired in diverse ways. The choice of repair depends on vowel quality and on the morphological category of the exponed vowels. There are few cases where a passive verb is derived from a vowel-final root. The only cases I found concerned roots with final /ɑ/ like [d͡zɑrɑ] 'servant'. For these roots, the final vowel surfaces faithfully before C-initial suffixes (4). Before V-initial suffixes, a glide is epenthesized between the two vowels.

(4) *Glide epenthesis after root-final /a/*

	d͡zɑrɑ	'servant'	vəgɑ	'witness'
+C	d͡zɑrɑ-n	'servant-DEF'	vəgɑ-n	'witness-DEF'
	d͡zɑrɑ-neɾ	'servant-PL'	vəgɑ-neɾ	'witness-PL'
+ V	d͡zɑrɑ[j]-ov	'servant-INS'	vəgɑ[j]-ov	'witness-INS'
	d͡zɑrɑ[j]-ut^{h}ʏn	'service'	vəgɑ[j]-ut^{h}ʏn	'testimony'
	ənd͡zɑ	'present'	mek^{h}enɑ	'machine'
+C	ənd͡zɑ-n	'present-DEF'	mek^{h}enɑ-n	'machine-DEF'
	ənd͡zɑ-neɾ	'present-PL'	mek^{h}enɑ-neɾ	'machine-PL'
+V	ənd͡zɑ[j]-ov	'present-INS'	mek^{h}enɑ[j]-ov	'machine-INS'
	ənd͡zɑ[j]-ut^{h}ʏn	'proof'	mek^{h}enɑ[j]-abed	'chief engineer'

When these roots are turned into simple active verbs (5), a glide is epenthesized before the theme vowel: [d͡zɑrɑj-e-l] 'to serve'. This epenthesis is surface-transparent. However in the corresponding passive, the glide is also found even though it is phonotactically unmotivated: [d͡zɑrɑj-v-i-l] 'to be served'.

(5) *Glide epenthesis after root-final /a/*

	d͡zɑrɑ	'servant'	vəgɑ	'witness'
Active	d͡zɑrɑ[j]-e-l	'to serve'	vəgɑ[j]-e-l	'to witness'
Passive	d͡zɑrɑ[j]-v-i-l	'to be served'	vəgɑ[j]-v-i-l	'to be witnessed'
	ənd͡zɑ	'present'	mek^{h}enɑ	'machine'
Active	ənd͡zɑ[j]-e-l	'to present'	mek^{h}enɑ[j]-e-l	'to plot'
Passive	ənd͡zɑ[j]-v-i-l	'to be presented'	mek^{h}enɑ[j]-v-i-l	'to be plotted'

For the active verb, a glide is epenthesized to straightforwardly repair vowel hiatus (6). There is no opacity. The morphology provides as input the root /d͡zɑrɑ/ and the verbal suffixes.

(6) *Phonotactically-motivated glide epenthesis in actives*

/d͡zɑrɑ/ + /-e-l/	MAX	ONSET	DEP
a. d͡zɑrɑ-e-l		*!	
b. ☞ d͡zɑrɑj-e-l			*

But for passives, the two analyses (root-derived vs. active-derived) diverge. If the passive verb was derived from the free-standing root /d͡zaɾa/, we would not expect any glide epenthesis (7a). But if the input is the active stem /d͡zaɾaj-/ with a glide, then the passive is correctly derived (7b).

(7) *Deriving glide epenthesis in passives*

a. *Root-derived: Phonotactically un-motivated glide epenthesis fails*

/d͡zaɾa/ + /-v-i-l/	MAX	ONSET	DEP
a. ☞ d͡zaɾa-v-i-l			
b. ☹ d͡zaɾaj-v-i-l			∗!

b. *Active-derived: Paradigmatically-motivated glide epenthesis*

[d͡zaɾaj-] + /-v-i-l/	MAX	ONSET	DEP
a. d͡zaɾa-v-i-l	∗!		
b. ☞ d͡zaɾaj-v-i-l			

Simply put, glide epenthesis applies to repair vowel hiatus in actives. This glide is then inherited by the passive, even though there is no vowel hiatus to repair.

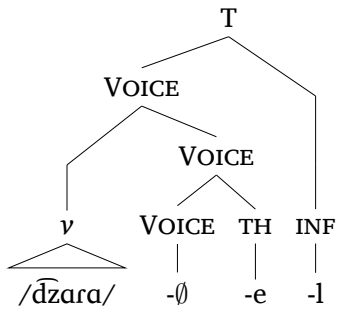
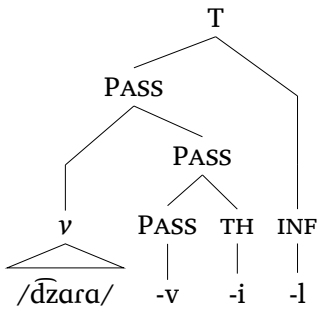
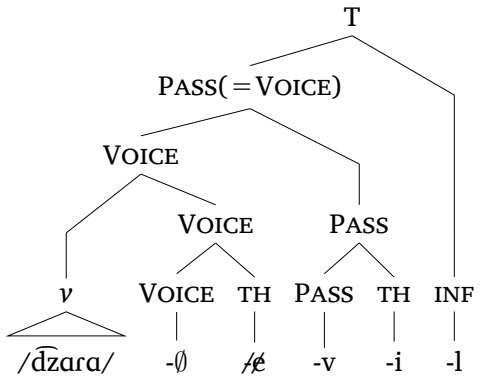
If the free-standing root were the input to the passive, then glide epenthesis would be an opaque overapplication. We would need additional constraints like Output-Output constraints that conspire to make the passive match the active (see §6.1). But, as I argue instead, the input to the passive is the pre-thematic stem of the active [d͡zaɾaj-]. Thus, what we see is a cyclic inheritance from one bound stem (the active stem) to another (the passive stem).

2.3 Formalizing bound-stem dependencies with cyclicity and affix deletion

In the previous section, I contrasted the root-derived and active-derived analysis in terms of the morphological input to the passive computation: the original root /d͡zaɾa/ (7a) vs. the phonologically-derived active stem [d͡zaɾaj-] (7b). For clarity, I formalize these two morphological derivations by using a) cyclicity and b) affix truncation or affix deletion.

First, let us establish the morphological structures that would accompany the root-derived and active-derived analyses. In their generative-typological study of passives, Alexiadou et al. (2015; 144) argue that there are two basic types of morphological structures for passives. In Table 1, I adopt their typology and illustrate with the Armenian noun *d͡zaɾa* 'servant' and its derived active-passive pair: *d͡zaɾaj-e-l* 'to serve' and *d͡zaɾaj-v-i-l* 'to be served'.

Table 1: Structure of active and passive form of verbs derived from the root $\sqrt{\text{d͡zaɾa}}$ 'servant'

Active *d͡zaɾaj-e-l* 'to serve'	Passive *d͡zaɾaj-v-i-l* 'to be served'	
a.	b. Passive over root (root-derived)	c. Passive over active (active-derived)
		

The passive suffix *-v-* is a PASS node, as a flavor of Voice or little *v* (Harley 2013, 2017). For languages with unproductive passivization like Greek, passive verbs are formed by adding a passive VOICE (PASS) layer on top of the verbalized root (a little *v*) layer. Such languages have root-derived passives (Table 1b). In contrast for languages like English with productive passivization, passive verbs are formed from active verbs (Bruening 2013; Alexiadou et al. 2018). Structurally, this means that passive VOICE is added on top of an active VOICE. Such languages have active-derived passives (Table 1c).

Given such morphological structures, we can now see how the derivation proceeds cyclically for both analyses (8). In a phase-based account like DM, Voice is a phase-head that triggers phonological cycles. One cycle is triggered by the active layer (the active Voice head), while another cycle is triggered by the passive layer (another Voice head).

Given a root $\sqrt{\text{serve}}$ /d͡zaɾa/, the root-derived morphology (Table 1b) undergoes one cycle shown in (8). In the single Passive cycle, the morphology provides the root plus passive suffix /-v-/ to the phonology, along with extra inflectional suffixes: /d͡zaɾa-v-i-l/. However, the derivation fails to create a glide. With this input, the phonology would need additional types of machinery like Output-Output (OO) constraints (Kenstowicz 1996; Benua 1997) to force the appearance of the glide (cf. §6.1).

(8) *Morphological derivation for root-derived vs. active-derived passives*

Input			Root-derived $\sqrt{\text{serve}}$ + PASS-TH-INF	Active-derived $\sqrt{\text{serve}}$ + TH + PASS-TH-INF
Active Cycle	Morphology	Spell-out		/d͡zaɾa/ + /-e/
	Phonology	Epenthesis		d͡zaɾaj-e
Passive Cycle	Morphology	Spell-out	/d͡zaɾa/ + /-v-i-l/	d͡zaɾaj-e + /-v-i-l/
		Truncation		d͡zaɾaj- /-v-i-l/
	Phonology	Epenthesis	d͡zaɾa-v-i-l (7a)	d͡zaɾaj-v-i-l (7b)
	Output		*d͡zaɾa-v-i-l	d͡zaɾaj-v-i-l

In contrast in the active-derived system (Table 1c), there is an additional cycle to temporarily form an active stem with a theme vowel. In the first (Active) cycle, the morphology adds the active theme vowel /-e/ to the root, causing the phonology to apply glide epenthesis: /d͡zaɾaj-e/. In the second (Passive) cycle, the morphology undoes the step of adding this theme vowel. A morphological rule of affix deletion or truncation is applied to derive /d͡zaɾaj-/. The rule deletes a theme vowel that is immediately before a passive suffix (9).[4] This string is then passed on to the phonology (tableau 7b).

(9) *Theme-vowel deletion (truncation) before the passive suffix*
TH → /-∅-/ / __⌒PASS

This theme vowel deletion rule is defined to delete the immediately preceding theme vowel morph. It does not delete just any vowel or syllable, but it is defined to target whatever segments expone the theme vowel, such as /e/. Thus, this rule has access to morphological structure, contra Bracket Erasure (Orgun 2002). The rule replaces the overt exponent of the theme vowel /e/ with the empty string ∅. The epenthetic glide however must be defined as not being part of the theme vowel morph; otherwise, the epenthetic glide would delete as well. For easier illustration, I segment the glide as part of the stem /dzaɾaj-/, but a more accurate representation would treat the epenthetic glide as belonging to no morpheme /d͡zaɾa-[j]-/.

As we later see in §3.3, it seems that the motivation behind our truncation rule is that the passive suffix cannot immediately follow a theme vowel. In contrast, Armenian does allow verbs with multiple theme vowels (10). For example, a simplex verb can undergo causativization. Both the root and the causative suffix take their own theme vowels. In some verbs, the pre-causative theme vowel can be optionally deleted. Thus, the passive suffix is exceptional in that it is banned from following a theme vowel.

[4]Within a cyclic active-derived framework, a reviewer suggests that an alternative to a truncation rule is to posit a morpheme-specific constraint requiring the passive suffix to follow a C-final stem (cf. Raffelsiefen 1999). This requirement will trigger the deletion of the theme vowel, by ranking this constraint over MAX. Another alternative to truncation is to make the UR of the passive be /-Xv/ where X is some defective phonological material that induces the melodic overwriting (= deletion) of the active theme vowel (Trommer & Zimmermann 2014) (Shanti Ulfsbjorninn, p.c.). For Armenian, all these options are descriptively equivalent to truncation. As a reviewer suggests, they would only be distinguishable if Armenian allowed a sequence of theme vowels /VV/ to precede the passive.

(10) *Multiple theme vowels in causatives*

/e/ + /e/	‘to serve’ d͡zaɾaj-e-l	‘to make serve’ d͡zaɾaj-e-t͡sən-e-l
/ɑ/ + /e/	‘to read’ gaɾtʰ-ɑ-l	‘to make read’ gaɾtʰ-ɑ-t͡sən-e-l
/(e)/ + /e/	‘to drink’ χəm-e-l	‘to make drink’ χəm-(e)-t͡sən-e-l
	√-TH-INF	√-TH-CAUS-TH-INF

Our cyclic analysis requires a rule of affix truncation or affix deletion. In early work on morphological theory, Aronoff (1976) proposed that morphological operations can truncate or delete entire morphs. His case studies came from English where a word like *nomin-ee* is derived from *nomin-ate* via truncation of the suffix *-ate*. In contemporary models of morphology like DM, we can re-formulate truncation as a readjustment rule that is triggered by the *-ee* suffix which deletes the *-ate* suffix (cf. Trommer 2012; p.330, type (g) in his list (11)).

Truncation rules are not widely accepted in the theoretical literature (Aronoff 1994). Furthermore, truncation rules are often criticized because many putative examples of truncation do not involve any phonological evidence for the deleted morph (Kiparsky 1982; 25; Kiparsky 1996; 10; Booij 1987; 61; Anderson 1992; 187).[5] However, there are attested cases of affix truncation which have morphosemantic dependencies and visible phonological effects (Polish: Szpyra 1989; Bethin 1990; Russian: Darden 1988; Hippisley 1998), but these are again contested. I argue that Armenian passives motivate a truncation rule because we do see phonological effects.

In sum, passive phonology has subtle evidence of opaque overapplication of phonological rules. I argue that for creating a passive verb, the most straightforward option is to use truncation with cyclically-derived bound stems (cf. cyclic bound stems in Bobaljik 1997).

3 Morphosemantic dependencies in the passive

The glide epenthesis data is a simple piece of evidence motivating the active-derived analysis. More evidence comes from the morphosemantics and morphotactics of passives. In brief, passive morphotactics and semantics are dependent on the active verb, not the free-standing root.

Within the framework of Alexiadou et al. (2015, 2018), a root-based morphology for passive formation predicts that Armenian passivization should be unproductive and not semantically derived from the active, in general. In contrast, a stem-based and active-

[5] As an interesting parallel in syntax, see exfoliation in clause reduction (Pesetsky prep).

derived morphology predicts that passivization should be productive and compositional from the active, again in general. As I document next, passivization is productive and compositional, and thus the stem-based active-derived approach makes the right predictions.

Note that in this section, we'll come across various passive verbs where there is an epenthetic schwa between the stem and the passive suffix. This schwa is absent in the active. These facts are discussed later in §4.1.

3.1 Passivization is productive

For productivity, nearly every Armenian active transitive verb has a passive counterpart, and vice versa, given the right lexical semantics. This generalization seems true for both Western Armenian (Haig 1982) and Eastern Armenian (Dum-Tragut 2009; Daniel & Khurshudian 2015). Data is in the supplementary materials. Productivity is predicted by active-derived morphology, but not by root-derived morphology (Alexiadou et al. 2015).

For the *active→passive* direction, in Boyacioglu & Dolatian (2020)'s database of Armenian verbs, I found 1947 transitive or ambitransitive verbs. For these verbs, I found a passive form in either online dictionaries (n = 1481) or in a Google search (n = 415). This means that 97.4% of active verbs had an attested passive counterpart. Of the remaining 51 verbs, I couldn't find a passive online. But these verbs were all extremely low-frequency or archaic verbs such that not even I, as a native speaker, recognized these verbs. But, in my native judgments, all of these leftover verbs can also be passivized. Thus, essentially 100% of Boyacioglu & Dolatian (2020)'s active transitive verbs can be passivized.

For the *passive→active* direction, Boyacioglu & Dolatian (2020) list 264 passives. Of these, 258 have an active transitive counterpart that I found in online dictionaries (97.7%). Three had a reflexive/reciprocal meaning and a synonymous active form: [kʰəʒd-i-l] or [kʰəʒdə-v-i-l] 'to quarrel'. Two verbs were not found online, either in an active or passive form. And one was a high-frequency word [goɾsə-v-i-l] 'to be lost' that isn't morphologically derived from an attested active *[goɾs-e-l].[6]

[6]As a reviewer notes, Eastern Armenian has cases of highly-frequent morphologically passive verbs that lack a corresponding transitive active verb (Dum-Tragut 2009; 178): [(ə)zbɑʁ-v-e-l] 'to be busy'. This is because Eastern Armenian tends to utilize passive morphology in order to form morphologically marked anticausatives (Haspelmath 1993), whereas Western Armenian instead utilizes a change in theme vowels: [(ə)spɑʁ-i-l] 'to be busy' (Donabédian 1997; Dolatian & Guekguezian 2022b). Within an active-derived analysis for passive morphology, these exceptions would require an expletive or meaningless Voice head below the passive suffix (Alexiadou et al. 2015; 109). This expletive Voice would trigger an intermediate cycle to compute a non-existing active form as a missing base. Such examples thus are not a problem for an active-derived morphology. The fact that they are the few exceptions to the rule is evidence that there is such a rule. Furthermore, such exceptions amount to a case of a 'missing base' for passive phonology (Trommer 2013; Mascaró 2016)

Based on these near-perfect correlations, passivization is productive in Armenian. As argued in depth by Alexiadou et al. (2015), such productivity is predicted by an active-derived morphology, but not a root-derived morphology. An active-derived approach predicts this productivity because passive stems are morphologically derived from active stems in this architecture (Table 1c). In contrast, a root-derived morphology predicts no significant correlations between passive and active stems, simply because the two types of stems are each derived from roots, independently of one another (Table 1b).

3.2 *ABA and cyclic containment

For semantic compositionality, the meaning of the passive is derived from that of the active, not the root. We find idiosyncrasies in the semantics of roots, actives, and passives. These dependencies create an *ABA effect which is predicted by the active-derived analysis, but not the root-derived analysis.

In the base case, we find a transparent semantic dependency across roots, active verbs, and passive verbs, i.e., the semantics of the root percolate up to the passive (11). The meaning of the passive verb is just the active verb minus an argument, and the meaning of the active verb is a verbalization of the root's meaning.[7]. Thus in the base case, the meaning of the root-active-passive triplet is semantically compositional (AAA).

(11) *Allosemy and semantic dependencies in passive formation*

Transparent semantics		Verb idiomaticity		Passive idiomaticity	
AAA		ABB		AAB or ABC	
tʰɑs	'class'	tʰɑʁ	'district'	nəʃɑn	'sign'
tʰɑs-e-l	'to classify'	tʰɑʁ-e-l	'to bury'	nəʃɑn-e-l	'to mark'
tʰɑs-v-i-l	'to be classified'	tʰɑʁ-v-i-l	'to be buried'	nəʃɑn-v-i-l	'to be betrothed'

In the non-base case, we see the significance of compositionality in allosemy (Marantz 2013) which creates a monotonicity or *ABA effect in passive semantics (for other *ABA effects in morphology, see Bobaljik 2012; Moradi 2019, 2021; Graf 2020). In some cases, the verbs develop their own idiomatic meaning to the exclusion of the root (ABB). Furthermore, in some cases, the passive verb develops its own meaning separate from the active (either AAB or ABC). For the AAB/ABC examples listed, it's not obvious to me if the active verb is fully compositional with respect to the root.

I list other such ABB cases in (12).[8]

(12) *Other examples of ABB patterns in passive semantics*

[7]Besides passivization, the passive suffix *-v-* can trigger other valency-reducing operations, such as forming reflexives and anti-causatives (Haig 1982; Dum-Tragut 2009). I set these nuanced semantic distinctions aside because they all behave morphophonologically the same.

[8]The schwa in *madən* 'finger' is epenthetic.

neʁ	'narrow'	ned	'arrow'	mɑdən	'finger (archaic)'
neʁ-e-l	'to upset'	ned-e-l	'to throw'	mɑdn-e-l	'to betray'
neʁ-v-i-l	'to be upset'	ned-v-i-l	'to be thrown'	mɑdnə-v-i-l	'to be betrayed'
gɑnuχ	'early'	voɾoʃ	'distinct'	pʰəʒiʃk	'doctor'
gɑnχ-e-l	'to anticipate'	voɾoʃ-e-l	'to decide'	pʰəʒəʃk-e-l	'to heal'
gɑnχə-v-i-l	'to be anticipated'	voɾoʃ-v-i-l	'to be decided'	pʰəʒəʃkə-v-i-l	'to be healed'

I list cases where the root is a bound root in (13). I'm not sure if the bound root and active verb should be treated as an AA or AB pattern. But importantly, the passive can have both a transparent meaning (AAA/ABB) and an idiomatic one (AAB/ABC).

(13) *Idiomatic passives*

kʰeɾ-	bound root	*ɑrn-*	bound root	*hɑn-*	doesn't exist
kʰeɾ-e-l	'to scratch'	ɑrn-e-l	'to take'	hɑn-e-l	'to remove'
kʰeɾ-v-i-l	'to be scratched'	ɑrnə-v-i-l	'to be taken'	hɑn-v-i-l	'to be removed'
	'to itch'		'to be offended'		'to undress'

What we don't see are cases where the root and passive have a transparent semantics together excluding the active (*ABA), such as hypothetical 'class'→'to eat→'to be classified'. In Kouyoumdjian (1970)'s dictionary of 60K words, I could not find a single passive verb whose meaning is non-compositional with respect to the active, but compositional over the root.

An active-derived morphology predicts such allosemy and monotonicity effects. In such an architecture, we get a containment hierarchy of root < active < passive (Table 1c). The root can percolate its semantics all the way up to the passive; but if the active creates a new meaning, then the passive cannot inherit the root's meaning (*ABA). But for a root-derived morphology, we get a containment hierarchy of root < active and root < passive (Table 1a,b), such that there is no derivational dependence between the active and passive. A root-based morphology incorrectly predicts that it should be possible to have passives that pattern with roots to the exclusion of actives.[9]

The above dependencies follow straightforwardly if we use an active-derived analysis for passives, such that passive phonology and semantics are computed from the active verb. In contrast, if we used a root-derived morphology for passives, we do not predict any of these dependencies simply because active and passive semantics are independently derived.

3.3 Stem-based morphotactics in the A-Class

Besides semantics, there are corners in the conjugation classes where we see that the passive verbs are directly built over active stems, not roots. Recall that Armenian has

[9]This argument however requires that the free-standing root form would show the basic semantics of the root morpheme. I thank Luke Adamson for discussion.

different conjugation classes for simple verbs. These include the E-Class which uses the *-e-* theme vowel, the I-Class with theme *-i-*, and the A-Class with theme *-ɑ-*. All passivization data so far has concerned the passives of E/I-Class verbs.

For the E/I-Class, the passive suffix follows the root without the theme vowel. However in the A-Class, this theme vowel surfaces. And a meaningless morph called the aorist *-t͡s-* is added between the theme vowel and the suffix (14). This affix is used as a past perfective marker in some inflectional cells. It is considered morphomic (Dolatian & Guekguezian 2022a). This meaningless affix likewise pops up in other inflectional cells. For example, participle suffixes cause the deletion of theme vowels in the E-Class, while they cause the appearance of *-t͡s-* for the A-Class.

(14) *Aorist stems in passives and participles*

	Active	Passivized	Subject participle
E-Class 'to classify'	tʰɑs-e-l	tʰɑs-v-i-l	tʰɑs-oʁ
A-Class 'to read'	gɑɾtʰ-ɑ-l	gɑɾtʰ-ɑ-t͡s-v-i-l	gɑɾtʰ-ɑ-t͡s-oʁ
	√-TH-INF	√-(TH-AOR)-PASS-TH-INF	√-(TH-AOR)-SPTCP

In a root-derived account, it is a morphological quirk that the morphology provides [tʰɑs-] as the input to the passive of the E-Class, while the morphology provides [gɑɾtʰ-ɑ-t͡s-] for the A-Class. However in an active-derived analysis, both patterns are unified via the interaction of theme vowel truncation and a rule inserting the /-t͡s-/ suffix (15) (Choi & Harley 2019; Dolatian & Guekguezian 2022a). The aorist suffix is inserted between the A-Class root and either the passive or participle. For illustration, I omit the covert little *v* and covert active Voice heads.

(15) a. *Node-sprouting rule for aorist insertion in passives and participles of A-Class*

$$\emptyset \Rightarrow \text{-t͡s-} \;/\; \begin{matrix} \sqrt{\text{A-Class}} \frown \text{TH} \frown \_\_ \frown \text{PASS} \\ \sqrt{\text{A-Class}} \frown \text{TH} \frown \_\_ \frown \text{SPTCP} \end{matrix}$$

b. *Theme-vowel deletion (truncation) before the passive and participle suffixes*

$$\text{TH} \rightarrow \text{/-}\emptyset\text{-/} \;/\; \begin{matrix} \_\_ \frown \text{PASS} \\ \_\_ \frown \text{SPTCP} \end{matrix}$$

Once this meaningless aorist is inserted, it bleeds the deletion of the theme vowel. To illustrate, consider the derivation in (16) for the passive of an E-Class and A-Class verb. Underlyingly, a theme vowel is present before the passive suffix. Aorist insertion then applies for the A-Class. Because of the inserted aorist suffix, the /ɑ/ theme vowel no longer immediately precedes the passive suffix, thus bleeding theme vowel deletion for the A-Class. The E-Class theme vowel however deletes because there is no intervener.

(16) *Cyclic derivation of spurious aorist insertion in passives*

	E-Class *tʰas-e-l* ‘to classify’					A-Class *gaɾtʰ-a-l* ‘to read’					
Input:	tʰɑs$_E$	-e	-v	-i	-l	gɑɾtʰ$_A$	-ɑ		-v	-i	-l
Insertion (15a):						gɑɾtʰ$_A$	-ɑ	-t͡s	-v	-i	-l
Deletion (9):	tʰɑs$_E$	-∅	-v	-i	-l						
	√	TH	PASS	TH	INF	√		TH	AOR	PASS	TH	INF

The existence of such a conjugation class is a welcome result for the active-derived analysis, while it is a neutral fact for the root-derived analysis. By examining these two conjugation classes, we can better understand the motivation behind truncation. There are various suffixes (the passive and participle) which can never immediately follow a theme vowel. This language-specific morphological constraint is satisfied in two ways. For the /e/ theme vowel, this constraint is satisfied by deleting the theme vowel. While for the theme vowel /ɑ/, this constraint is satisfied by inserting the aorist suffix.

4 Cyclic dependencies and schwas

To summarize, there is phonological and morphosemantic evidence that passive stems are derived from active stems. This section goes through phonological processes that control the distribution of schwas. We again find that passives show an opaque distribution of schwas because of a cyclic dependency between the passive and the active.

The data is however quite complicated and involves pre-passive epenthesis (§4.1), vowel reduction (§4.2), and rhotic metathesis (§4.3). The epenthesis data can work with or without an active-derived analysis. But the interaction of epenthesis with the latter two phonological processes requires an active-derived analysis.

In contrast to these three processes, glide epenthesis was straightforward to model. Thus any individual element of our formalization for these schwa facts can be debated. But ultimately, the generalization still holds that we see an active-passive cyclic connection.

4.1 Pre-passive epenthesis

As a morpheme-specific rule, the passive suffix can trigger schwa epenthesis after consonant clusters (17b).

(17)

a.			b.		
tʰɑs	‘class’		nerg	‘paint’
tʰɑs-e-l	‘to classify’		nerg-e-l	‘to paint’
tʰɑs-v-i-l	‘to be classified’		nergə-v-i-l	‘to be painted’

When the root of a verb ends in a VC sequence, the passive is formed by adding the suffix *-v-*: *aʁ.vil* ‘to be salted’ (18a). But for Western Armenian, if the root ends in a CC cluster,

then the passive triggers schwa epenthesis immediately before it: *jɐr.kʰə.vil* ‘to be sung’ (18b) (Fairbanks 1948; 81-2, Ա ճառյան 1971; 272).

(18) *Epenthesis in passives in Western Armenian*

a. *Final-VC roots*

ɑʁ	‘salt’	kʰot͡s	‘closed’	tʰɑd	‘trial’
ɑ.ʁ-e-l	‘to salt’	kʰo.t͡s-e-l	‘to close’	tʰɑ.d-e-l	‘to judge’
ɑʁ-v-i-l	‘to be salted’	kʰot͡s-v-i-l	‘to be closed’	tʰɑd-v-i-l	‘to be judged’

b. *Final-VCC roots*

jeɾkʰ	‘song’	zɑŋkʰ	‘bell’	bɑd.ɾɑst	‘prepared’
jeɾ.kʰ-e-l	‘to sing’	zɑŋ.kʰ-e-l	‘to phone’	bɑd.ɾɑs.t-e-l	‘to prepare’
jeɾ.kʰə-v-i-l	‘to be sung’	zɑŋ.kʰə-v-i-l	‘to be phoned’	bɑd.ɾɑs.tə-v-i-l	‘to be prepared’

The trigger for schwa epenthesis here is not phonologically predictable. The CC sequences above can form complex codas, whether morpheme-medially (19a) or before a morpheme boundary (19b).

(19) *Sample of licit complex codas*

a. *Complex codas morpheme-internally*

tʰɑ**ɾkʰ**.mɑ.nel	‘to translate’	i**ŋkʰ**.nɑ.gɑn	‘personal’	ɑ**st**.vɑd͡z	‘God’
ne**ɾkʰ**.nɑ.jin	‘inner’	ɑ**ŋkʰ**.li.jɑ	‘England’	ɑ**st**.χ-er	‘star-PL’

b. *Complex codas before morpheme boundaries*

ʃə.no**ɾkʰ**-neɾ	‘grace-PL’	ɑɾ.t͡su**ŋkʰ**-neɾ	‘tear-PL’	hɑ.kʰu**st**-neɾ	‘clothes-PL’
əs.pʏ**ɾkʰ**-neɾ	‘diaspora-PL’	je.ɾɑ**ŋkʰ**-neɾ	‘shade-PL’	i.mɑ**st**-neɾ	‘meaning-PL’

There is no restriction in the language that complex codas can’t precede a morpheme boundary. There are a few C-initial suffixes (20). Of the few C-initial suffixes that exist, most can follow a CC sequence, but just the passive cannot.

(20) *Other C-initial suffixes can follow consonant clusters*

hɑ**st**	‘thick’	ve**ɾt͡ʃ**	‘end’
hɑ**st**-n-ɑ-l	‘to get thick’	ve**ɾt͡ʃ**-t͡sən-e-l	‘to cause to end’
nɑχɑ**nt͡s**	‘jealousy’	ɑɾeve**lkʰ**	‘east’
nɑχɑ**nt͡s**-kod	‘jealous’	ɑɾeve**lkʰ**-t͡si	‘easterner’

Thus, it is the passive suffix itself which is idiosyncratically banned from following a CC sequence. This morpheme-specific behavior can be modeled with the following morpheme-specific constraint: *CC-PASS. This constraint outranks DEP. Because of this constraint, no epenthesis is triggered after a VC cluster (21b), but we see epenthesis after a CC cluster (21c). Such idiosyncrasies work with either an input root or input active stem.

(21) a. *CC-PASS: Assign a violation if the passive suffix *-ɐ-* follows a CC cluster

b. *No epenthesis in VC-passive cluster (17a)*

Root-derived: /tʰɑs/ /-v-i-l/ Active-derived: [tʰɑs-] /-v-i-l/	*CC-PASS	DEP
a. ☞ tʰɑs.vil		
b. tʰɑ.sə.vil		∗!

c. *Epenthesis in CC-passive cluster (17b)*

Root-derived: /nerg/ /-v-i-l/ Active-derived: [nerg-] /-v-i-l/	*CC-PASS	DEP
a. nerg.vil	∗!	
b. ☞ ner.gə.vil		∗

The constraint *CC-PASS is a morpheme-specific markedness constraint. Such constraints have historically been controversial. Many argue that constraint indexation should be limited to faithfulness constraints, not markedness constraints (Itô & Mester 1999). But cross-linguistically, there are analyses which have used indexed markedness (Pater 2000, 2009; Flack 2007; Gouskova 2007; Inkelas & Zoll 2007; Jurgec 2010; Jurgec & Bjorkman 2018). I argue that the Armenian data also motivates indexed markedness.[10]

Another idiosyncrasy is the location of the schwa. After a CC sequence, the passive triggers schwa epenthesis directly before the passive. This creates a syllable structure of *VC.Cə-CV*, with a medial open syllable. This is in contrast to the language-general behavior of schwa epenthesis in Armenian (22) (Vaux 1998; ch3). Within a morpheme, an underlying cluster of 3 consonants is syllabified as *V.CəC.CV*, with a medial closed syllable.[11]

(22) /mɑkʰl͡ts-i-l/ 'to climb' /pedrvar/ 'February' /ɑbstɑmpʰ/ 'rebel'
mɑ.kʰəl.t͡sil pʰe.dər.var ɑ.bəs.tɑmpʰ

Thus, the locus of the epenthetic schwa in the passive is morphologically idiosyncratic. I follow Dolatian (forthcoming) and treat schwa epenthesis as controlled by right-to-left

[10] A reviewer notes that this and other passive-specific constraints (23) recapitulate the contexts for pre-passive epenthesis. This is correct, but this is a moot issue. Because pre-passive epenthesis is morpheme-specific and arbitrary, any rule-based or constraint-based formulation of this process will be descriptive and arbitrary. An alternative is to replace pre-passive epenthesis with a rule of allomorphy: the passive is /-əv/ after a CC, but /-v/ elsewhere. In the active-derived morphology, such a replacement would work with explaining the epenthesis and vowel reduction data (§4.2), but we would still need CONTIG-PASS to handle rhotic metathesis (§4.3). In a root-derived analysis, such a replacement doesn't overcome the analysis's difficulty with glide epenthesis, semantics, or vowel reduction and rhotic metathesis.

[11] These schwas are epenthetic because 1) they are unmarked in the orthography, and 2) their insertion is completely predictable from Armenian syllabification.

syllabification. As a coda language, Armenian prefers creating word-medial closed syllables (CəC) over medial open ones (Cə) via schwa epenthesis.[12] In contrast for the passive, let us assume that the location of its schwa is determined by a morpheme-specific contiguity constraint: CONTIG-PASS (23). For the morpheme that precedes the passive, this morpheme's final substring must be contiguous in the output (McCarthy & Prince 1995; Lamontagne 1996).

(23) *Constraints for pre-passive schwa*

a. CONTIG-PASS: In the morpheme that precedes the passive suffix, assign a violation if the portion of the output that is in correspondence with the input (= not deleted nor epenthetic) does not form a contiguous substring.
This constraint is violated in $xy \rightarrow x\langle z\rangle y$ and $xuy \rightarrow x\langle v\rangle y$, satisfied in $xy \rightarrow xy\langle z\rangle$ and $xy \rightarrow x$

b. *ALIGN-σ-L: Assign a violation for every segment that separates a syllable from the left edge.

The above contiguity constraint is an OUTPUT-CONTIGUITY constraint that blocks internal epenthesis (McCarthy & Prince 1999; appendix). In passives, the contiguity constraint ensures that schwas are preferably inserted at the morpheme boundary, and not inside the root (cf. similar morpheme-internal contiguity effects in other languages: Kenstowicz 1994; Alber & Plag 2001; Landman 2002; Gouskova 2003; Silverman 2011). Thus, in order to avoid a contiguity violation, the schwa is added between the root and passive in *ner.gə.vil*, and not inside the root **ne.ɾəg.vil* (24).

(24) *Epenthesis at morpheme boundaries for passives*

Root-derived: /neɾg/ /-v-i-l/ Active-derived: [neɾg-] /-v-i-l/	*CC-PASS	CONTIG-PASS	DEP	ALIGN-σ-L
a. neɾg.vil	$*$!			4
b. ne.ɾəg.vil		$*$! (ɾ-g)	$*$	7
c. ☞ neɾ.gə.vil			$*$	8

The above two generalizations are for Western Armenian. First, the passive suffix cannot surface after a CC sequence, thus a derived CC-v sequence at the stem-passive juncture triggers a phonological repair (schwa epenthesis). Second, the location of the epenthetic schwa is immediately before the passive suffix. Dialectal variation shows that the two generalizations however are independent (25). In Eastern Armenian, the passive suffix

[12] Capturing the general behavior of schwa epenthesis is a complex task. I set this aside (Vaux 1998; ch3). Various analyses for general schwa epenthesis have been posited (see survey in Dolatian forthcoming). The analysis of epenthesis in this paper is compatible with any of these analyses for schwa epenthesis. One has to simply replace the constraint ALIGN-σ-L with the appropriate theory-specific constraints on epenthesis.

can follow complex codas, but it triggers a preceding schwa after unsyllabifiable clusters (Ղարագյուլյան 1979; 162; Vaux 1998; 29,82). Thus the constraint *CC-PASS is non-existent or low-ranked in Eastern Armenian, while CONTIG-PASS is still high-ranked. Note the dialects have some differences in segments and theme vowels.

(25) *Pre-passive epenthesis across Western and Eastern Armenian*

	Western	Eastern	
*CC-PASS in WA not EA	vɑɾ.t͡s-e-l	vɑɾ.t͡sʰ-e-l	'to hire'
	vɑɾ.t͡sə-v-i-l	vɑɾt͡sʰ-v-e-l	'to be hired'
CONTIG-PASS in both WA and EA	χɑɾ.n-e-l	χɑr.n-e-l	'to mix'
	χɑɾ.nə-v-i-l	χɑr.nə-v-e-l	'to be mixed'
	*χɑ.ɾən-v-i-l	*χɑ.rən-v-e-l	

Thus, for Western Armenian, the passive suffix idiosyncratically triggers the epenthesis of a schwa between a root-final CC cluster and itself. Both the trigger and location of the schwa are morphologically idiosyncratic. Dialectal variation for these two idiosyncrasies is evidence that pre-passive epenthesis is truly morphologically arbitrary. The subsequent sections present complications from vowel reduction.

4.2 Cyclic opacity in vowel reduction

Having formalized pre-passive epenthesis, this section discusses vowel reduction (Vaux 1998; 148; Khanjian 2009). I adopt the reduction analysis and formalization from Dolatian (2021, forthcoming) In brief, destressed high vowels are reduced to schwa or zero (4.2.1). Outside of passive verbs, the choice of schwa or zero is transparently based on the phonology (4.2.2). Informally, the schwa form is used in /V(C)C_C-CV/ contexts (where the vowel is in a closed syllable), while the zero form is used in /VC_C-V/ contexts (where the vowel is in an open syllable). In passives, we transparently derive the schwa form in /VCC_C-CV/ contexts (where the syllable is closed), but we opaquely overuse the zero form in /VC_C-CV/ contexts (where the syllable is also closed); the zero form is inherited from the active stem.

4.2.1 Basics of vowel reduction in Armenian

In Armenian, stress is final. But there is evidence that stress is cyclically computed. Given a root with a final high vowel /i, u/, that high vowel is stressed: *kʰír* 'writing'. If a derivational suffix is added, stress will shift to the suffix and the high vowel can reduce to either schwa (26a-i) or zero (26a-ii). The derivational suffix can create either a verb

or non-verb.[13] Compounds are formed by concatenating stems with the linker *-a-*, and compounds likewise show reduction (26b).

(26)

a.	i.	kʰíɾ	‘writing’		ii.	dəχúɾ	‘sad’
		kʰəɾ-é-l	‘to write’			dəχɾ-í-l	‘to be sad’
		kʰəɾ-ɑgán	‘literary’			dəχɾ-ɑlí	‘sorrowful ’
b.	i.	kʰíɾ + báh	‘... + guard’		ii.	dəχúɾ + t͡sájn	‘... + voice’
		kʰəɾ-ɑ-báh	‘librarian’			dəχɾ-ɑ-t͡sájn	‘sad-voiced’

Destressed reduction is systematic for high vowels. But reduction generally does not occur for non-high vowels (27a), nor for high vowels that were unstressed in the base (27b).

(27) *Lack of reduction in other morphophonological contexts*

a. *No reduction for non-high vowels*					
dɑɾpʰéɾ	‘different’	ɑɾóχt͡ʃ	‘healthy’	həbáɾd	‘proud’
dɑɾpʰeɾ-é-l	‘to differentiate’	ɑɾoχt͡ʃ-utʰýn	‘health’	həbɑɾd-ɑgán	‘boastful’
b. *No reduction in unstressed high vowels*					
kʰumáɾ	‘amount’	kʰiʃéɾ	‘night’	məχitʰáɾ	‘comforter’
kʰumɑɾ-é-l	‘to calculate’	kʰiʃeɾ-ɑnó t͡s	‘nightgown’	məχitʰɑɾ-é-l	‘to comfort’

Thus, reduction targets *destressed* high vowels, i.e., vowels that lost stress during the derivation. In contrast, *unstressed* high vowels surface faithfully, i.e., vowels that never received stress in the first place. This acts as a derived environment effect (Khanjian 2009). To formalize this process, I adopt Dolatian (2021)’s OT analysis for vowel reduction.

First, final stress is assigned via a high-ranking alignment constraint ALIGN(STR,R) or STR-R that places stress on the rightmost vowel (28). Stress from the root can shift to the suffix, thus the constraint ID[STRESS] against stress shift is low-ranked.

(28) *Constraints and ranking for stress shift*

a. ALIGN(STR,R) $\sim$ STR-R: Stress is on the rightmost syllable
b. ID[STRESS]: A vowel does not gain or lose stress in the derivation
c. STR-R $>>$ ID[STRESS]

Unstressed high vowels are not reduced, thus the output constraint *i,u[-STRESS] is ranked lower than the faithfulness constraints MAX (29).

(29) *Constraints on unstressed reduction*

[13] If an inflectional suffix is added, then vowel reduction is generally blocked. This blocking is tangential to this paper and set aside. See Dolatian (2021) for description and analysis.

a. MAX: a segment is not deleted
b. **i,u*[-STRESS]: there are no unstressed high vowels
c. MAX >> **i,u*[-STRESS]

I illustrate these constraints and rankings with the word pair (30): root *kʰumár* 'amount' and active verb *kʰumaɾ-é-l* 'to calculate' where stress shifts with no reduction of any vowels. Simply put, **i,u*[-STRESS] is too low-ranked to block stress shift or to reduce any high vowels. Note that destressed vowel reduction requires that the input is a stressed root [kʰumáɾ] and not an underlying root /kʰumaɾ/.

(30) *Stress shift and absence of unstressed vowel reduction*

a. Cycle 1: *kʰumár* 'amount'

/kʰumaɾ/	STR-R	MAX	ID[STRESS]	**i,u*[–STRESS]
a. ☞ kʰumáɾ			*	*
b. kʰmáɾ		*!	*	
c. kʰúmaɾ	*!		*	

b. Cycle 2: *kʰumaɾ-é-l* 'to calculate'

[kʰumáɾ] /-e-l/	STR-R	MAX	ID[STRESS]	**i,u*[–STRESS]
a. kʰumáɾ-e-l	*!			*
b. ☞ kʰumaɾ-é-l			**	*
c. kʰmaɾ-é-l		*!	**	
d. kʰúmaɾ-e-l	*!*		**	

Although the constraints ID[STRESS] and **i,u*[-STRESS] are too low-ranked to trigger unstressed high vowel reduction, their conjunction is what triggers destressed reduction (31). A destressed high vowel is a high vowel which a) underwent a change in stress (= violates ID[STRESS]), and b) would surface as unstressed (= violates **i,u*[-STRESS]). I use the shorthand **ǐ,ŭ* for this constraint conjunction (Łubowicz 2003). I use the diacritic on *ǐ* to mark destressing.

(31) *Constraints on destressed reduction*

a. **i,u*[-STRESS]&ID[STRESS] ∼ **ǐ,ŭ*: Penalize a high vowel which is unstressed *and* which has gained or lost stress in the derivation
b. **ǐ,ŭ* >> MAX

I illustrate the application of this constraint below for the verb *dəχɾ-í-l* 'to be sad' which is derived from the base *dəχúr* 'sad' (32).

(32) *Deriving destressed reduction in dəχɾ-í-l* 'to be sad'

[dəχúɾ] /-i-l/		STR-R	*ĭ,ŭ	MAX	ID[STRESS]	*i,u[–STRESS]
a.	dəχúɾ-i-l	∗!				∗
b.	dəχŭɾ-í-l		∗!		∗∗	∗
c. ☞	dəχɾ-í-l			∗	∗	

Candidate (a) *dəχúr-i-l* loses because stress shift must apply. With final stress, candidate (b) *dəχŭr-í-l* loses because its high vowel is destressed. The high vowel violates both ID[STRESS] and **i,u[-STRESS]*, thus it violates the conjunction **ĭ,ŭ*. The winning candidate is *dəχɾ-í-l* where the destressed high vowel is deleted. Note that the input must be the stressed root [dəχúɾ] and not unstressed /dəχuɾ/, otherwise there would be no destressed high vowels.

4.2.2 Phonological factors in reduction

The previous section provided the basic constraints that trigger the reduction of destressed high vowels. This section briefly describes the phonotactic contexts which determine the choice of the output form: reduction to schwa vs. deletion.

The basic distribution is as follows (33). If the syllable is an open syllable, and if deletion would create a syllabifiable cluster, then the vowel is reduced to zero. In all other cases, the vowel is reduced to schwa. Thus, we see a schwa if the syllable is closed or if deletion would create an unsyllabifiable cluster.

(33) *Contexts for reduction to schwa vs. reduction to zero*

			Schwa?	Zero?	Open?	Syllabifiable?
'noise'	ɑʁ.múg	'to disquiet'	ɑʁ.mə.g-é-l	*ɑʁm.g-e-l	✓	✗
'sign'	níʃ	'to mark'	nə.ʃ-e-l	*nʃ-e-l	✓	✗
'fortress'	bɑ.ɾísp	'to fortify'	bɑ.ɾəs.p-é-l	*bɑɾs.p-é-l	✗	✓
'Persian'	bɑɾ.síg	'Persia'	*bɑɾ.sə.g-ɑs.tán	bɑɾs.k-ɑs.tán	✓	✓
'explicit'	me.gín	'to interpret'	*me.gə.n-é-l	meg.n-é-l	✓	✓
'drum'	tʰəm.púg	'drummer'	*tʰəm.pə.k-ɑhár	tʰəmp.k-ɑhár	✓	✓

For our purposes, the important point is that the schwa form is used in /V(C)C_C-CV/ contexts (because the syllable is closed), while the zero form is used in /VC_C-V/ contexts (because the syllable is open).

To capture the reduction patterns of destressed high vowels, I use the following set of constraints. For illustration, our analysis is simplified from Dolatian (forthcoming)'s extensive study on the phonotactics of vowel reduction.

Destressed high vowels are preferably reduced to a schwa instead of deleted (34). This is captured by ranking MAX over ID[F]; the latter constraint is violated whenever a high

vowel changes its features.[14] Deletion is blocked whenever it would create an unsyllabifiable complex margin via *CC]$_\sigma$, which is shorthand for a finite list of illicit complex margins. Deletion is triggered by the avoidance of open *Cə* syllables created by vowel reduction.[15] The surface schwa is not epenthetic, due to DEP outranking MAX.

(34) a. *Constraints for vowel reduction*
   i. *CC]$_\sigma$: Do not have a syllable margin more complex than what is allowed by the phonotactics of the language.
   ii. **Cə*: Assign a violation for an open syllable that has a schwa.
   iii. ID[F]: Assign a violation if the features of a high vowel changed (= if the vowel reduced to a schwa).

   b. *Constraint ranking for vowel reduction*
   *CC]$_\sigma$, *ĭ,ŭ >> *Cə, DEP >> MAX >> ID[F]

With the above constraints, we can derive the simple cases of reduction to schwa (35): *aʁ.múg* 'noise' to *aʁ.mə.gél* 'to disquiet', and reduction to zero: *me.gín* 'explicit' to *meg.nél* 'to interpret'. The input is the stressed base and the concatenated suffix. For reduction to schwa, candidates *aʁmúgel* (a) and *aʁmŭgél* (b) lose because of high-ranking constraints for stress shift and against destressed high vowels. Deletion in *aʁmgel* is blocked because it would create an illicit complex coda **ʁm*. The winner is reduction to schwa: *aʁ.mə.gél* (c). This candidate creates an open syllable, thus violating **Cə*. This candidate wins over a surface-identical candidate **aʁ.mə$_2$.gel* (e) where the high vowel is deleted and a schwa is inserted into the same slot; this is due to DEP outranking ID[F]. The indexing distinguishes derived from epenthetic schwas.

(35) *Deriving reduction to schwa*

[ɑʁmú$_1$g] /-e-l/		STR-R	*CC]$_\sigma$	*ĭ,ŭ	DEP	*Cə	MAX	ID[F]
a.	ɑʁ.mú$_1$.gel	*!						
b.	ɑʁ.mŭ$_1$.gél			*!				
c. ☞	ɑʁ.mə$_1$.gél					*		*
d.	ɑʁm.gél		*!				*	
e.	ɑʁ.mə$_2$.gél				*!	*	*	

For reduction to zero (36), the main two candidates are the winner *meg.nél* (d) and the loser **me.gə.nél* (c). The relative ranking of MAX over ID[F] treats schwa-reduction as

[14] For illustration, I assume that ID[F] is violated when a vowel changes its features, but not if it is deleted.

[15] Based on data from both schwa epenthesis, vowel reduction, and underlying schwas, Dolatian (forthcoming) argues that the appropriate output constraint is a conjunction **...Cə...&F* (more accurately **...Cə...&FAITH*) between a constraint against medial /Cə/ syllables and faithfulness violations. This allows underlying /Cə/ syllables to surface, while derived /Cə/ syllables are blocked. I simplify for this paper.

the default pattern. Deletion is triggered to avoid the open *Cə* syllable in **me.gə.nél* (c). Candidate (e) *me.gə₂.nél* loses because it is harmonically bounded; MAX and DEP are both violated because the high vowel is deleted and a schwa is added in the same slot.

(36) *Deriving reduction to zero*

[me.gí$_1$n] /-e-l/		STR-R	*CC]$_\sigma$	*ĭ,ŭ	DEP	*Cə	MAX	ID[F]
a.	me.gí$_1$.nel	∗!						
b.	me.gĭ$_1$.nél			∗!				
c.	me.gə$_1$.nél					∗!		∗
d. ☞	meg.nél						∗	
e.	me.gə$_2$.nél				∗!	∗	∗	

The above data and discussion focused on roots which precede a vowel-initial suffix. There is limited data on the behavior of vowel reduction before C-initial suffixes. This is because the vast majority of derivational suffixes in Armenian are V-initial. Furthermore, compounds generally surface with a vocalic element between the two stems. Exceptions are few.

To preview the passive data, note that among the few cases of C-initial suffixes and vowel-less compounds, there are some words which show vowel reduction (37). Here, the reduced high vowel is always replaced by a schwa and never deleted. This follows from the fact that the high vowel would be in closed syllable.

(37)

t͡ʃúɾ	‘water’	dún	‘house’
t͡ʃəɾ-véʒ	‘waterfall’	dən-dés	‘housekeeper’
χíʁd͡ʒ	‘conscience’	dəɾdúnt͡ʃ	‘complaint’
χəʁd͡ʒ-gód	‘conscientious’	dəɾ.dənt͡ʃ-gód	‘complainer’

In very few cases (38), there are roots which alternate in the choice of zero vs. schwa before V-initial (38a-ii) vs. C-initial morphology (38a-iii). Deletion is allowed only before before V-initial morphology because only then is the reduced vowel in a deletable open syllable.

(38)

a.	i.	jeɾ.gíɾ	‘world’	b.	i.	gɑ.gúʁ	‘soft’
	ii.	jeɾg.ɾ-ɑ.jín	‘worldly’		ii.	gɑg.ʁ-ɑ-n-á-l	‘to get soft’
	iii.	jeɾ.gəɾ-bɑ.k^h-é-l	‘to adore’		iii.	gɑ.gəʁ-n-á-l	‘to get soft’

To illustrate, the tableaux in (39) show vowel reduction in the two synonymous verbs from (38b): one where the stem precedes a vowel suffix /-ɑ-n-ɑ-l/ vs. a consonant /-n-ɑ-l/.[16] The high vowel reduces to zero in the former, but not the latter.

[16]The glossing for /-(ɑ)-n-ɑ-l/ is ‘(LV)-INCH-TH-INF’.

(39) *Output of vowel reduction varies by post-root segment*

a. *Reduction as deletion before vowel-initial suffix*

[gɑgúʁ] /-ɑ-n-ɑ-l/	STR-R	*CC]$_\sigma$	*ĭ,ŭ	DEP	*Cə	MAX	ID[F]
a. gɑ.gŭ.ʁɑ.nál			∗!				
b. gɑ.gə.ʁɑ.nál					∗!		∗
c. ☞ gɑg.ʁɑ.nál						∗	

b. *Reduction to schwa before consonant-initial suffix*

[gɑgúʁ] /-n-ɑ-l/	STR-R	*CC]$_\sigma$	*ĭ,ŭ	DEP	*Cə	MAX	ID[F]
a. gɑ.gŭʁ.nál			∗!				
b. ☞ gɑ.gəʁ.nál							∗
c. gɑgʁ.nál		∗!				∗	

All the above data is transparently derivable from our current constraint set. In brief, the choice of schwa vs. zero is transparent from the local phonotactic and syllabic structure of the high vowel. There is no opacity in the choice of output for high vowel reduction.

Given this formalization, the next section shows how passives show an opaque use of schwas in vowel reduction. Specifically, because the passive suffix is a consonant, we incorrectly predict that the schwa form should be used for all passive verbs. Instead, we find that verbs transparently use the schwa form in /VCC_C-CV/ contexts (§4.2.3), while they opaquely use the zero form in /VC_C-CV/ (§4.2.4).

4.2.3 Reduced schwas in actives and passives

When a root is used to form an active verb, a destressed high vowel of the root will by default reduce to a schwa. The schwa stays in the active if a) the syllable is open, and b) deletion would create an unsyllabifiable cluster. The schwa is likewise kept in the corresponding passive (40).

(40) *Reduction to schwa in actives and passives*

zúd	'pure'	níʃ	'sign'
zə.d-é-l	'to filter'	nə.ʃ-é-l	'to mention'
zəd-v-íl	'to be filtered'	nəʃ-v-íl	'to be mentioned'
ɑʁ.múg	'noise'	gəs.mít^h	'pinch'
ɑʁ.mə.g-é-l	'to disquiet'	gəs.mə.t^h-é-l	'to pinch'
ɑʁ.məg-v-í-l	'to be disquieted'	gəs.mət^h-v-í-l	'to be pinched'

As expected, if the root ends in a complex coda, the passive triggers pre-passive epenthesis (41).

(41) *Reduction to schwa in passives, with pre-passive epenthesis*

kʰírg	'bosom'	zúsp	'restrained'
kʰər.g-é-l	'to embrace'	zəs.p-é-l	'to restrain'
kʰər.gə-v-íl	'to be embraced'	zəs.pə-v-íl	'to be restrained'
gɑ.múɾt͡ʃ	'bridge'	pə.ʒíʃk	'doctor'
gɑ.mər.t͡ʃ-é-l	'to bridge'	pə.ʒəʃ.k-é-l	'to heal'
gɑ.mər.t͡ʃə-v-íl	'to be bridged'	pə.ʒəʃ.kə-v-í-l	'to be healed'

For the active and passive, keeping the schwa is predictable from our previous constraint set. For such verbs, it doesn't matter whether we use the root-derived or active-derived analysis.

First consider the root-derived analysis. For roots without final clusters like *ɑʁmúg*, the passive winner is *ɑʁ.məg.víl* (42aa) with reduction to schwa. Deletion would create an unsyllabifiable cluster: **ɑʁmg.víl* (42ab,f). Deleting the vowel and then inserting a schwa in the same location violates contiguity and DEP: **ɑʁ.mə$_2$g.víl* (42ac). Deleting the vowel and inserting a vowel somewhere else entails violations of contiguity: **ɑ.ʁə$_2$mg.víl* (42ad,e). The active-derived analysis in contrast is just a faithful mapping from /ɑʁməg-/ (42b).

(42) *Deriving* [ɑʁ.məg.víl] 'to be disquieted'

a. *Root-derived: Successful derivation from the root* [ɑʁ.múg] 'noise'

[ɑʁ.mú$_1$g] /-v-i-l/		*CC]$_\sigma$	*CC-PASS	CONTIG-PASS	DEP	*CƏ	MAX	ID[F]
a.	☞ ɑʁ.mə$_1$g.víl							*
b.	ɑʁmg.víl	*!	*!				*	
c.	ɑʁ.mə$_2$g.víl			*!			*	
d.	ɑ.ʁə$_2$mg.víl	*!	*!	*! (ʁ-m)	*		*	
e.	ɑ.ʁə$_2$m.gə$_3$.víl			*! (ʁ-m)	**	*	*	
f.	ɑʁm.gə$_2$.víl	*!			*	*	*	

b. *Active-derived: Successful derivation from the active stem in* [ɑʁ.məg-é-l] 'to disquiet'

[ɑʁ.məg-] /-v-i-l/		*CC]$_\sigma$	*CC-PASS	CONTIG-PASS	DEP	*CƏ	MAX	ID[F]
a.	☞ ɑʁ.məg.víl							
b.	ɑʁmg.víl	*!	*!				*	

For space, I omit the constraint that triggers stress shift and that blocks the losing candidate **ɑʁmúg-v-i-l*. And, I omit the constraint **ĭ,ŭ* for blocking the losing candidate **ɑʁmŭg-v-i-l* that has an unreduced vowel. Similar results are obtained for stems with a final cluster (41), not shown.

4.2.4 Unmotivated deletion of reduced vowels in passives

The previous section looked at active-passive pairs where a vowel is reduced to schwa. In contrast in the verbs below (43), the root's high vowel is deleted in the active verb. In the corresponding passive verb, the high vowel is still absent. Instead, there is pre-passive epenthesis (Ղարագյուլյան 1979; 41-2).

(43)	a.	tʰɑɾ.pʰín	'blacksmith, forger'	b.	gəɾ.gín	'double, again'
		tʰɑɾpʰ.n-é-l	'to forge'		gəɾg.n-é-l	'to repeat'
		tʰɑɾpʰ.nə-v-í-l	'to be forged'		gəɾg.nə-v-í-l	'to be repeated'

For deriving the active verbs, it is useful to contrast two types of roots and their derivatives. For the roots in (44a), the high vowel is flanked by consonants C_1,C_2 which can form a falling-sonority complex coda in other words. To illustrate, I place subscript *F* on the first consonant. In contrast, for the roots in (44b), the high vowel is flanked by consonants which cannot form a complex coda in other words. These consonants have rising or flat sonority. To illustrate, I place the subscript *R* on the first consonant.

(44) *Passives with deletion, categorized by sonority*

a. $V.C_F\check{V}.C\text{-}V$			
d͡zɑ.ʁíg	'flower'	huɾuɬ́ʰ	'charm'
d͡zɑʁ.g-é-l	'to ornament'	huɾtʰ-é-l	'to enchant'
d͡zɑʁ.gə-v-í-l	'to be ornamented'	huɾtʰə-v-í-l	'to be enchanted'
b. $V.C_R\check{V}.C\text{-}V$			
megín	'explicit'	pʰɑʒín	'section'
meg.n-é-l	'to interpret'	pʰɑʒ.n-é-l	'to divide'
meg.nə-v-í-l	'to be interpreted'	pʰɑʒ.nə-v-í-l	'to be divided'

In the active, both types of consonant sequences are hetero-syllabic. Thus, both types of active verbs surface without a schwa: *me.gín* to *meg.nél* 'to interpret'. For the active verbs, deriving the schwa-less forms is straightforward from the surface syllable structure (see earlier tableau 36). However, for the passive verbs, a simple root-derived analysis cannot generate the right forms.

For the active verbs above, their passive forms all utilize pre-passive epenthesis: *d͡zɑʁ.gə.víl*, not **d͡zɑ.ʁəg.víl* 'to be ornamented'. For the root-derived analysis, it is paradoxical why there is deletion and then subsequently pre-passive epenthesis. The paradox is illustrated in the tableaux of (45) below.

Informally, because the verb is the shape /VC_C-CV/, the root-derived analysis would treat the high vowel as in a closed syllable, thus incorrectly predict a schwa. In contrast,

the active-derived analysis treats the passive shape /VC_C-CV/ as derived from an intermediate shape /VC_C-V/, where the high vowel is in an open syllable and transparently uses the zero form.

With the root as input, the incorrect winner utilizes reduction to schwa for both types of verbs. Given the root *d͡ʒa.ʁíg*, the incorrect winner is **d͡ʒa.ʁəg.víl* (45a.a). The desired winner *d͡ʒaʁ.gə.víl* (c) fails because the deletion + epenthesis is unmotivated and more costly than just reducing the vowel to a schwa. For the root *me.gín*, the same incorrect winner is also incorrectly derived for the same reason.[17] The passive cannot utilize deletion because the resulting consonant cluster is not syllabifiable as a complex coda: **məgn.víl*. Thus the root-derived analysis incorrectly expects reduction to schwa instead of deletion + epenthesis: **me.gən.víl*.

(45) *Root-derived: Failed derivation for reduction to zero in passives*

a. *Failed for* [d͡ʒɑʁ.gə.víl] 'to be ornamented' *from the root* [d͡ʒɑ.ʁíg] 'flower'

[d͡ʒɑ.ʁí$_1$g] /-v-i-l/	*CC]$_\sigma$	*CC-Pass	Contig-Pass	Dep	*Cə	Max	Id[f]
a. ☞ d͡ʒɑ.ʁə$_1$g.víl							*
b. d͡ʒɑʁg.víl		*!				*	
c. ☹ d͡ʒɑʁ.gə$_2$.víl				*!	*!	*	

b. *Failed for passive* [meg.nə.víl] 'to be interpreted' *from the root* [me.gín] 'clear'

[me.gí$_1$n] /-v-i-l/	*CC]$_\sigma$	*CC-Pass	Contig-Pass	Dep	*Cə	Max	Id[f]
a. ☞ me.gə$_1$n.víl							*
b. megn.víl	*!	*!				*	
c. ☹ meg.nə$_2$.víl				*!	*!	*	

To further illustrate why the root-derived system fails, consider the following near-minimal pair. Both roots in (46) have the same prosodic shape *CVCíC*. Before a C-initial suffix like the inchoative /-n-/, the destressed high vowel in (46a) is replaced by a schwa in the same location. This output can be generated by our analysis (see earlier tableau 39). But before the passive suffix, the high vowel in (46b) is deleted and we see pre-passive epenthesis.

(46)

a.			b.		
	gɑgúʁ	'soft'		megín	'clear'
	gɑgəʁ-n-á-l	'to get soft'		*megən-v-í-l	'to be interpreted'
	*gɑgʁə-n-á-l			megnə-v-í-l	

The same uniform phonological grammar cannot generate both types of outputs in (46) without some additional factor. The question then is "why does the high vowel delete

[17] Note that *ʁg* is a licit fricative-stop complex coda, while *gn* is an illicit complex coda.

in passives?" As before, I argue that that the reason is because of identity between the passive stem and the *active* stem: the active-derived analysis. Passive stems like [d͡zɑʁgə-v-i-l] are formed transparently and faithfully from the active stem in [d͡zɑʁ.g-e-l] and not via reduction from the root [d͡zɑʁig].

(47) *Active-derived: successful derivation for reduction to zero in passives*

a. *Passive* [d͡zɑʁ.gə.víl] *from the active stem in* [d͡zɑʁ.g-é-l] 'to ornament'

[d͡zɑʁ.g-] /-v-i-l/		*CC]$_\sigma$	*CC-PASS	CONTIG-PASS	DEP	*Cə	MAX	ID[F]
a.	d͡zɑ.ʁə$_2$g.víl			∗! (ʁ-g)	∗			
b.	d͡zɑʁg.víl		∗!					
c. ☞	d͡zɑʁ.gə$_2$.víl				∗	∗		

b. *Passive* [meg.nə.víl] *from the active stem in* [meg.n-é-l] 'to ornament'

[meg.n-] /-v-i-l/		*CC]$_\sigma$	*CC-PASS	CONTIG-PASS	DEP	*Cə	MAX	ID[F]
a.	me.gə$_2$n.víl			∗! (g-n)	∗			
b.	megn.víl	∗!	∗!					
c. ☞	meg.nə$_2$.víl				∗	∗		

In the active-derived analysis, passive verbs don't actually show vowel reduction (48). Vowel reduction applied in the cycle between the root and the active stem: [d͡zɑʁíg] → [d͡zɑʁg-é-]. In the passive cycle, the active theme vowel is truncated. The only new schwas that can appear are from pre-passive epenthesis: [d͡zɑʁg-é-] → [d͡zɑʁgə-v-í-l].

(48) *Morphological derivation for vowel reduction for root-derived vs. active-derived passives*

Input			Root-derived $\sqrt{\text{flower}}$ + PASS-TH-INF	Active-derived $\sqrt{\text{flower}}$ + TH + PASS-TH-INF
Root Cycle	Morphology	Spell-out	/d͡zɑʁig/	/d͡zɑʁig/
	Phonology	Stress	d͡zɑʁíg	d͡zɑʁíg
Active Cycle	Morphology	Spell-out		d͡zɑʁíg + /-e/
	Phonology	Stress		d͡zɑʁĭg-é
		Reduction		d͡zɑʁg-é
Passive Cycle	Morphology	Spell-out	d͡zɑʁíg + /-v-i-l/	d͡zɑʁg-é + /-v-i-l/
		Truncation		d͡zɑʁg- /-v-i-l/
	Phonology	Stress	d͡zɑʁĭg-v-í-l	d͡zɑʁg-v-í-l
		Reduction	d͡zɑʁəg-v-í-l	
		Epenthesis		d͡zɑʁgə-v-í-l
	Output		*d͡zɑʁəg-v-í-l (45a)	d͡zɑʁgə-v-i-l (47a)

Thus, just like glide epenthesis, vowel reduction shows that passive verbs are phonologically computed from active stems. If passives were derived directly from roots without referencing the active stem, then we would get the wrong patterns of vowel reduction. The next section shows the same pattern from rhotic metathesis.

4.3 Cyclic opacity in rhotic metathesis

In the paper so far, we have seen that whenever a destressed high vowel reduced to a schwa, the schwa was in the same location as the original high vowel (49a). But in a restricted set of phonological contexts that involve rhotic onsets, the schwa is in a different position (49b). I first show that these mismatches are due to a process of rhotic-schwa metathesis: *ɾə→əɾ* (§4.3.1). I then show that this metathesis process is likewise active in passive verbs, but variably so (§4.3.2). The variation can only be captured if we derive passive stems from active stems.

(49)

a.			b.		
	ɑz.nív	‘sincere’		bɑd.ɾíg	‘patrician’
	ɑz.nə.v-u.tʰýn	‘sincerity’		*bɑd.ɾə.g-u.tʰýn	‘order of patricians’
	*ɑ.zən.v-u.tʰýn			bɑ.dəɾ.g-u.tʰýn	

4.3.1 Rhotic metathesis in Armenian

First, consider prosodic contexts where the high vowel has a rhotic onset and is deleted (50). The vowel deletes as long as it is in an open syllable and as long as its deletion would create a syllabifiable consonant cluster.

(50) *Reduction as deletion in deletable contexts around rhotics*

kʰɑ.ɾún	‘spring’	pʰo.tʰo.ɾíg	‘storm’
kʰɑɾ.n-ɑ-n-á-l	‘to become spring’	pʰo.tʰoɾ.g-á-l	‘to bluster’
ɑ.ɾítʰ	‘occasion’	mə.de.ɾím	‘intimate’
ɑɾ.tʰ-é-l	‘to occasion’	mə.deɾ.m-u.tʰýn	‘intimacy’

As for contexts where a schwa is necessary, we find two positions for the schwa. First, if the destressed high vowel is in a closed syllable, then there is no metathesis (51). The schwa stays in the original position of the high vowel.

(51) *Reduction to schwa in closed syllables with rhotics*

ɾúŋkʰ	‘nostril’	ɾúmpʰ	‘bomb’
ɾáŋ.kʰ-ɑ-jín	‘nasal’	ɾəm.pʰ-ág	‘bombshell’
ɑn.de.ɾúnt͡ʃ	‘forlorn’	zə.ɾínt͡ʃ	‘bray (n)’
ɑn.de.ɾənt͡ʃ-u.tʰýn	‘forlorn-ness’	zə.ɾən.t͡ʃ-á-l	‘to bray’
bɑd.ɾínt͡ʃ	‘lemon-balm’	zəm.ɾúχt	‘emerald (n)’
bɑd.ɾən.t͡ʃ-a-t͡ʃúr	‘balm extract’	zəm.ɾəχ.t-e.ʁén	‘emerald goods’

However, if the vowel would have been in a word-medial open syllable (52), then we find metathesis (Ղարագյուլյան 1979; 42).[18]

(52) *Vowel reduction and vowel metathesis in word-medial open syllables*

dəz.ɾúg	‘leech’	gəd.ɾídʒ͡	‘valiant’
də.zəɾ.g-ɑ-t͡sév	‘leech-shaped’	gə.dəɾ.dʒ͡-u.t^{h}ýn	‘valiance’
*dəz.ɾə.g-ɑ-t͡sév		*gəd.ɾə.dʒ͡-u.t^{h}ýn	
gənt^{h}.ɾúg	‘frankincense’	dʒ͡əʃk.ɾíd	‘precise’
gən.t^{h}əɾ.g-ɑ.jín	‘frankincense (adj)’	dʒ͡əʃ.kəɾ.d-u.t^{h}ýn	‘precision’
*gənt^{h}.ɾə.g-ɑ.jín		*dʒ͡əʃk.ɾə.d-u.t^{h}ýn	

However, rhotic metathesis is restricted to *word-medial* open syllables. Armenian allows *ɾə* syllables at the edges of a word. Word-initial *ɾə* syllables are mostly formed via vowel reduction, while final *ɾə* syllables are formed with the definite suffix *-ə*.

(53)

a. *#ɾə*		b. *ɾə#*	
ɾús	‘Russian (person)’	pók^{h}.ɾ-ə	‘small-DEF
ɾə.s-ɑ-χós	‘Russian-speaking’	déd.ɾ-ə	‘tract-DEF

In sum, the reduced schwa is metathesized with a rhotic if the rhotic-schwa sequence forms a word-medial open syllable. This is straightforwardly captured with the following constraint set (54).

(54) *Constraints and ranking for rhotic metathesis*

a. **...ɾə...*: Assign a violation for a word-medial open syllable of the shape *ɾə*.[19]
b. LINEARITY (Lin): Assign a violation if a pair of segments x, y have reverse precedence relations in the input and output ($=$ no metathesis)
c. *CC]$_{\sigma}$ >> *...ɾə... >> LIN, DEP >> *Cə

Linearity outranks **Cə*. Thus, metathesis is not used to metathesize any open *Cə* syllables: *aʁ.múg* ‘noise’ to *aʁ.mə.gél* ‘to disquiet’ (not shown). But **...ɾə...* outranks linearity. Thus word-medial rhotic-schwa syllables are replaced with *əɾ* (55): *bad.ɾíg* ‘patriarch’ → *ba.dəɾ.gu.t^{h}ýn* (c) or *ba.də’ɾ.gu.t^{h}ýn* (d) ‘order of patriarchs’. The choice of either metathesis (candidate c) vs deletion + epenthesis (candidate d) depends on the relative ranking of LIN and DEP. The choice is ultimately tangential.

[18] Metathesis is also reported for open *lə* syllables (Vaux 1998; 30). The relevant data is vanishingly rare, so I do not discuss it.

[19] We can simplify this constraint by instead arguing that open *ɾə* syllables are marked. Anchor constraints block metathesis at word-edges. I however use our more ad-hoc constraint for illustration.

(55) *Rhotic metathesis in rhotic-schwa syllables* (49b)

[bɑd.ɾí$_1$g] /-ut^{h}ʏn/			*CC]$_\sigma$	*ĭ,ŭ	*...ɾə...	LIN	DEP	*Cə	MAX	ID[F]
a.		bɑd.ɾĭ$_1$.gu.t^{h}ʏ́n		∗!						
b.		bɑd.ɾə$_1$.gu.t^{h}ʏ́n			∗!			∗		∗
c.	☞	bɑ.də$_1$ɾ.gu.t^{h}ʏ́n				∗ (d-ɾ)				∗
d.	☞	bɑ.də$_2$ɾ.gu.t^{h}ʏ́n					∗		∗	

The above data concerns how rhotic metathesis behaves across most derivatives. However, there are effects of contiguity and dialectal variation for rhotic metathesis in passive verbs. This is discussed next.

4.3.2 Variation in rhotic metathesis in passives

This section looks at rhotic metathesis in passives. Generally, rhotic metathesis applies in passives in Eastern Armenian (EA) (Ղարագյուլյան 1974; 163), but not in Western Armenian (WA) (Ղարագյուլյան 1979; 41). In order to capture this dialectal variation, I argue that we need to derive passives from actives, not from roots.

For the active verbs in (56), the verb is not derived from a root with a high vowel. When passivized, the rhotic metathesizes in Eastern Armenian but not Western. Note that Western Armenian has only the rhotic /ɾ/, while Eastern has the rhotics /ɾ,r/. Eastern Armenian passives use the theme vowel /-e-/.

(56) *Rhotic metathesis passives with bound roots: ɾə-PASS → əɾ-PASS ∼ ɾə-PASS*

	p^{h}ənd.ɾ-é-l	'to look for'	d͡zɑʁ.ɾ-é-l	'to mock'
WA	p^{h}ənd.ɾə-v-í-l	'to be looked for'	d͡zɑʁ.ɾə-v-í-l	'to be mocked'
EA	p^{h}ən.t^{h}əɾ-v-é-l		t͡sɑ.ʁəɾ-v-é-l	

The same variation is found in passives whose derivation involves vowel reduction (57). We find metathesis in Eastern Armenian, but not Western Armenian.

(57) *Rhotic metathesis in passives with vowel reduction*

	mɑ.k^{h}úɾ	'clean'	χən.t^{h}íɾ	'problem'	gə.ʃíɾ	'balance'
	mɑk^h.ɾ-é-l	'to clean'	χənt^h.ɾ-é-l	'to ask'	gəʃ.ɾ-é-l	'to weigh'
WA	mɑk^h.ɾə-v-í-l	'to be cleaned'	χənt^h.ɾə-v-í-l	'to be asked'	gəʃ.ɾə-v-í-l	'to be weighed'
EA	mɑ.k^{h}əɾ-v-é-l		χən.t^{h}əɾ-v-é-l		kə.ʃəɾ-v-é-l	

The above dialectal variation can be captured with the simple constraint reranking in (58). First consider the active-derived analysis. In Western Armenian, CONTIG-PASS outranks **...ɾə...*. This will block rhotic metathesis in Western Armenian passives: *mak^h.ɾə.víl*. Epenthesizing an internal schwa **ma.k^{h}əɾ.vil* violates the contiguity of the passive stem when. The cheapest option is to epenthesize a post-root schwa.

(58) *Active-derived: Variant rankings for rhotic metathesis for passives*

a. Western Armenian: CONTIG-PASS >> *...ɾə...

[mɑkʰ.ɾ-] /-v-i-l/		*CC]$_\sigma$	CC-PASS	CONTIG-PASS	*...ɾə...	LIN	DEP
a.	mɑkʰɾ.víl	∗!	∗!				
b.	mɑ.kʰəɾ.víl			∗!			∗
c. ☞	mɑkʰ.ɾə.víl				∗		∗

b. Eastern Armenian: *...ɾə... >> CONTIG-PASS

[mɑkʰ.ɾ] /-v-e-l/		*CC]$_\sigma$	CC-PASS	*...ɾə...	CONTIG-PASS	LIN	DEP
a.	mɑkʰɾ.vél	∗!	∗!				
b. ☞	mɑ.kʰəɾ.vél				∗		∗
e.	mɑkʰ.ɾə.vél			∗!			∗

In contrast, in Eastern Armenian, we have the reverse ranking. This will trigger internal epenthesis to resolve the *ɾə* syllable, at the expense of violating contiguity: *mɑ.kʰəɾ.vél*.

The above dialectal variation is easily captured in the active-derived analysis, in which the passive stem is derived from the active stem. Such a stem has already undergone reduction in the active cycle, so there is no actual vowel reduction involved. But if we instead made passives derived from the root, not the active stem, then we are unable to capture the dialectal variation. Specifically, the Western system of no metathesis is un-formalizable with the constraint CONTIG-PASS. I illustrate below.

If the passive were derived directly from the root *mɑ.kʰúr*, then the least costly derivation is to directly reduce the high vowel into a schwa. Doing so would not need any epenthesis or metathesis at all: **mɑ.kʰəɾ.víl* (59.b). This incorrect winner does not violate any of the output constraints, contiguity constraints, or linearity constraints that are violated by the candidates with the *ɾə* syllable (d,e): *mɑkʰ.ɾə.víl*.

(59) *No blocking of rhotic metathesis in WA rhotics without active stems*

[mɑ.kʰú$_1$ɾ] /-v-i-l/		*CC]$_\sigma$	CC-PASS	CONTIG-PASS	*...ɾə...	LIN	DEP
a.	mɑkʰɾ.víl	∗!	∗!				
b. ☞	mɑ.kʰə$_1$ɾ.vil						
c.	mɑ.kʰə$_2$ɾ.víl			∗!			∗
d. ☹	mɑkʰ.ɾə$_1$.víl				∗!	∗	
e. ☹	mɑkʰ.ɾə$_2$.víl				∗!		∗

In effect, given our independently motivated constraints and rankings, the only way to capture the WA metathesis system is to derive passive stems from active stems. This is because the only reason why WA blocks metathesis in passives is in order to maintain identical contiguity between the passive stem and the active stem, not between the passive stem and the root. In sum, rhotic metathesis provides further morphophonological evidence that passive stems are computed from active stems.

5 Allomorphy in passive formation

The paper has described the cyclic dependence between the passive and active of simplex verbs. Such a dependency is visible from the phonology and semantics. For the sake of completeness, this section considers the other conjugation classes.

Besides simplex verbs, two other major categories are complex verbs and irregular verbs. Complex verbs include an additional valency-changing suffix after the root. Irregulars include suppletive verbs, verbs with obsolete conjugations, and verbs with irregularity in some paradigm cell or another. The different classes and their class size frequency are listed in (60) based on Boyacioglu & Dolatian (2020)'s database of 3,257 verbs.

(60) *Distribution of conjugation classes*

Regular simplex:	E-Class (50.75%)	I-Class (14.03%)	A-Class (4.05%)
Regular complex:	Causative (10.41%)	Passive (8.23%)	Inchoative (8.17%)
Irregular:	Miscellaneous irregular (2.98%)		Suppletive (0.52%)

Regular E-Class and I-Class verbs straightforwardly form their passive by adding the suffix *-v-* to their active stems. These verbs are estimated to form 64% of verbs. In contrast, some smaller verb classes like causatives, inchoatives, and suppletive verbs undergo allomorphy (underlined in 61). Passive formation of all these classes is surveyed in Dolatian & Guekguezian (2022a) in terms of aorist stem formation.

(61) *Allomorphy in passive formation*

	E-Class 'to serve'	Causative 'to make scratch'	Inchoative 'to receive'	Suppletive 'to put'
Active	d͡zɑɾɑj-e-l	kʰeɾ-e-t͡sən-e-l	əst-ɑ-n-ɑ-l	tʰən-e-l
	√-TH-INF	√-TH-CAUS-TH-INF	√-LV-INCH-TH-INF	√-TH-INF
Passive	d͡zɑɾɑj-v-i-l	kʰeɾ-e-t͡s-v-i-l	əst-ɑ-t͡s-v-i-l	tʰəɾ-v-i-l
	√-PASS-TH-INF	√-TH-CAUS-PASS-TH-INF	√-LV-AOR-PASS-TH-INF	√-PASS-TH-INF

For both the root-derived and active-derived analyses, it is an independent fact that the above words utilize allomorphy. The allomorphy of passives can be easily integrated into any analysis for the phonology of passives.

For example, consider the active-derived analysis (62). For an E-Class active/passive verb, the morphology provides the root /d͡zaɾɑ/ 'servant'. In the active cycle, a glide is epenthesized. The glide is inherited by the passive cycle. But in a suppletive verb like 'to put', the root is spelled-out as the allomorph /tʰəɾ-/ if there is a passive morpheme in the word; otherwise as /tʰən-/. For the passive verb, we go through a phonologically vacuous active cycle (= the theme vowel is added and removed without causing any phonological changes).

(62) *Morphological derivation for phonologically regular vs. morphologically irregular active-derived passives*

Input			'to serve' $\sqrt{\text{serve}}$ + TH-INF	'to be served' $\sqrt{\text{serve}}$ + TH + PASS-TH-INF	'to put' $\sqrt{\text{put}}$ + TH-INF	'to be put' $\sqrt{\text{put}}$ + TH + PASS-TH-INF
Root Cycle	Morpho	Spell-out	/d͡zaɾɑ/	/d͡zaɾɑ/	/tʰən/	/tʰəɾ/
Active Cycle	Morpho	Spell-out	/d͡zaɾɑ/ + /-e-l/	/d͡zaɾɑ/ + /-e/	/tʰən/ + /-e-l/	/tʰəɾ/ + /-e/
	Phono		d͡zaɾaj-e-l	d͡zaɾaj-e	tʰən-e-l	tʰəɾ-e
Passive Cycle	Morpho	Spell-out		d͡zaɾaj-e + /-v-i-l/		tʰəɾ-e + /-v-i-l/
		Truncation		d͡zaɾaj- /-v-i-l/		tʰəɾ- /-v-i-l/
	Phono			d͡zaɾaj-v-i-l (7b)		tʰəɾ-v-i-l
	Output		d͡zaɾaj-e-l	d͡zaɾaj-v-i-l	tʰən-e-l	tʰəɾ-v-i-l

For the active-derived analysis, the passive morpheme conditions allomorphy of the root during spell-out. The allomorphy applies cyclically early, before any phonological cycles, and thus preventing phonological pressures to maintain identity between the active stem and passive stem (IO-constraints).

Based on the above data, a reviewer wonders that because some verbs like 'to put' require root allomorphy between the active and passive, then perhaps we can argue that verbs like 'to serve' likewise use active-passive allomorphy. In other words, the root uses one allomorph /d͡zaɾaj-/ for passive verbs, and /d͡zaɾɑ-/ elsewhere. Alternatively, the root uses an allomorph /d͡zaɾaj-/ for verbs, and an elsewhere form /d͡zaɾɑ-/. The problem with these alternatives is that they miss the exceptionless generalization that for simplex regular verbs (= the E/I-Class are 64% of verbs), the shape of the verb stems is morphophonologically predictable from this elsewhere form. When this elsewhere form /d͡zaɾɑ/ is before a vowel (like in the active stem), we get glide epenthesis or vowel reduction: /d͡zaɾaj-/. This phonologically modified form is then inherited by the passive.

6 Alternative treatments

The paper's main empirical contribution is the following. In order to form the correct phonological shape of regular passive stems in Armenian, the phonology must reference the active stem, not the root. Semantic evidence comes from *ABA effects, morphological evidence comes from the A-Class, and phonological evidence for this came from glide epenthesis, vowel reduction, and rhotic metathesis. These phonological rules would apply in active stems, and their phonological result would be inherited by passive stems. If the

passive stem was derived from or only referenced the root, then these processes would form the wrong output.

Given these empirical generalizations, the next question is how they can be derived from and expressed by the grammar. The data is quite complicated, and its complications encourage us to think up multiple alternative treatments. I discuss a few of the most salient ones and their deficiencies.

6.1 Output-output constraints

To model the data, I argued that we cyclically derive passives from active stems, and this cyclicity is masked via a truncation rule against pre-passive theme vowel morphemes. A criticism of this approach however is that truncation requires a complex derivation. An alternative is Output-Output constraints.

For a passive verb like [d͡zaɾaj-v-i-l] 'to be served', the corresponding root is [d͡zaɾa] 'servant', and the active form is [d͡zaɾaj-e-l] 'to serve' (63). For the passive, I argued for an active-derived account, in which a glide is inherited by the passive stem because the input was the active stem /d͡zaɾaj-/ (63a). An alternative root-derived analysis (63b) is to make the input be the root /d͡zaɾa/ (the local base), and the phonology forces the phonology forces a glide via an Output-Output constraint OO-MAX that references the active verb (the remote base).

(63) *Deriving glide epenthesis in passives using stems vs. OO-constraints*

a. *Active-derived: Input is active stem*

[d͡zaɾaj-] /-v-i-l/		MAX	ONSET	DEP
a.	d͡zaɾa-v-i-l	∗!		
b. ☞	d͡zaɾaj-v-i-l			

b. *Root-derived: Input is root but phonology has Output-Output constraints*

B^L:[d͡zaɾa] /-v-i-l/ B^R:[d͡zaɾaj-e-l]		OO-MAX	ONSET	DEP
a.	d͡zaɾa-v-i-l	∗!		
b. ☞	d͡zaɾaj-v-i-l			∗

In the OO-account, the passive verb is morphologically derived from the root [d͡zaɾa], but its phonology references both the root (via IO-faithfulness) and the active verb [d͡zaɾaj-e-l] (via OO-faithfulness). The root is a local base for computation (given from the morphological input), while the active verb is a remote base that the phonology accesses from the lexicon. The phonology is able to further look into the active verb, and make the passive verb reference the active stem. All of our IO-constraints for glide epenthesis, vowel

reduction, and rhotic metathesis are replaced by OO-constraints. [20]

Output-output constraints are a common device in OT literature on the morphology-phonology interface (Benua 1997; Downing et al. 2005). Analyses that use such constraints assign various labels such as Paradigm Uniformity (Kenstowicz 1996), Lexical Conservatism (Steriade 1997, 1999; Breiss 2021), or Optimal Paradigms (McCarthy 2005; Downing 2005). But such an account for the Armenian data is subject to four points of criticism.

The first criticism is empirical. OO-constraints can capture the phonological dependencies between passive and actives, but they don't capture the morphosemantic ones. For a root-derived analysis with OO-constraints, it is an accident that passive semantics, morphotactics, and phonology are computed from actives.[21]

The second is conceptual. Whether an analysis allows the use of OO-constraints is entirely based on one's premises. In some contemporary models of the phonology-morphology interface, phonology can access the morphophonological structure of only its input, not of any other related forms. Such accounts are called localist accounts (Embick 2010), and they include Distributed Morphology and Stratal OT (Bermúdez-Otero 2011, 2012, 2018b,a). In contrast, OO-constraints require a globalist architecture where the phonological derivation has access to transderivational relationships (cf. Chung 1983). Because of this premise-based variation, one can dismiss an OO-based account if they simply don't allow such accounts in their own framework. In contrast, cyclic analyses are plausible in both localist and globalist frameworks.

The third weakness is overgeneration. The OO-account predicts that we should also be able to see phonological sensitivity to the root in Armenian passive verbs (IO faithfulness), but we don't. Throughout passive phonology and semantics, I have not found any instance where the passive stem needs to reference the phonology/semantics of the root as distinct from the active stem. There is thus no evidence for a phonological input-output connection between passive stems and roots, but only between passives and actives.

The fourth weakness is indirectness or redundancy. The OO-account boils down to saying "The phonological shape of the passive stem is computed in part by referencing the shape

[20]Note that the constraint OO-MAX evaluates the similarity between two bound stems (the active and passive). The stem in these words is not a free-standing word. In earlier discussion of OT, the need to reference morphologically bound items is a common critique against transderivational OT (cf. Orgun 1996; Orgun & Dolbey 2007). However, more recent work allows OO-constraints that reference bound stems (Steriade 2008, 2016; Steriade & Yanovich 2015).

[21]Note that I only consider the extremes of possible morphological structure: root-derived morphology with OO-constraints (which captures the phonology but not the semantics) vs. active-derived morphology with cyclic vowel deletion (which captures both phonology and semantics). The reviewers note that as a compromise, we could use active-derived morphology with OO-constraints, but with a stipulation that the active theme vowel is not inserted in a passive verb. In this architecture, the semantic effects are captured. But the phonology never exploits this morphology and still uses OO-constraints. Thus the phonological and semantic generalizations are independent of each other in this middle-ground.

of the active stem". This is exactly the idea behind our cyclic active-derived analysis. The OO-account however doesn't implement this generalization with cyclicity. Furthermore, the cyclic account automatically and correctly predicts that all phonological processes in the passive stem must reference the active stem as their input. In contrast, the OO-based account in principle permits constraints for every possible phonological process (cf. criticisms by Kiparsky 2000).

As a caveat, one could argue that even cyclic accounts can overgenerate. Different strata can have wildly different rules, cophonologies, or constraints. But for the Armenian data, we didn't see a case of active stems and passive stems have separate cophonologies. Instead, the cyclic analysis for the Armenian passive requires only cyclicity without strata.

6.2 Diachronic origin of passive [-v-] as abstract /-u-/

This paper focused on the synchronic nature of the passive suffix. I briefly discuss an alternative root-derived analysis based on the diachronic origins of the passive.

Diachronically, the passive suffix *-v-* came from the Classical Armenian theme vowel *-u-* (Haspelmath 1987; 41; Ջահուկյան 2010; 811; Մուրադյան 2018). At some point in the development of modern Armenian, passive verbs were formed by adding *-u-* between the root and the *-i-* theme vowel. The sequence /-u-i/ was grammaticalized as a passive suffix plus theme vowel. And because of vowel hiatus, the /-u-/ became a [-v-]. Pre-passive schwa epenthesis then developed later, likely due to grammaticalizing an excrescent schwa (Ղարագյուլյան 1979; 43). Such an origin resembles a reanalysis from a root-selecting node (theme or little *v*) to an outer node (PASS) (cf. developments in other Indo-European languages: Grestenberger 2021).

The consequence of this diachronic development is that, even though modern passive stems precede a consonant [-v-], their phonological shape is due to preceding a vowel **-u-* at an earlier stage of the language. For the modern speaker, the effects of this mismatch are that the phonological shape of the passive stem depends on the phonological shape of the active stem.

Based on this diachrony, Vaux (1998; 105) adopts an alternative root-based account whereby the passive suffix [-v-] is underlyingly /-u-/ (64). He requires a cycle for each morpheme (except for the infinitive). For a passive verb like *d͡ʒa.ɾaj-v-í-l*, the word is underlyingly /d͡ʒaɾa-u-i-l/. After the root cycle, the /-u-/ triggers a host of phonological changes like glide epenthesis or reduction that account for the alternations discussed in §4. The /-u-/ becomes [-v-] in a later cycle due to vowel hiatus. Any resulting consonant cluster then arbitrarily triggers epenthesis.[22]

[22]A reviewer argues that pre-passive epenthesis is predictable for Vaux's alternative. But this is false. As surveyed in (§4.1), other C-initial suffixes are fine after CC clusters. It is the passive suffix which is unique in being banned after all CC clusters in WA like **d͡ʒaʁg.-vil*; thus we still need a morpheme-specific constraint

(64) *Alternative root-derived analysis with abstract /-u-/*

Input		‘to be served’ √serve-PASS-TH-INF /d͡zaɾa-u-i-l/	‘to be ornamented’ √flower-PASS-TH-INF /d͡zaʁig-u-i-l/
Root Cycle 1	Stress	d͡zaɾá	d͡zaʁíg
Passive Cycle 2	Suffixation	d͡zaɾá + /-u/	d͡zaʁíg + /-u/
	Glide epenthesis	d͡zaɾáj-u	
	Stress/reduction	d͡zaɾaj-ú	d͡zaʁg-ú
Theme Cycle 3	Suffixation	d͡zaɾaj-é + /-i-l/	d͡zaʁg-ú + /-i-l/
	Frication	d͡zaɾaj-v-í-l	d͡zaʁg-v-í-l
	Epenthesis		d͡zaʁgə-v-í-l

This analysis works because Vaux’s “abstract” vowel does the job of OO-constraints or cyclic vowel truncation. Armenian likewise has a *u*-to-*v* rule in vowel hiatus repair (Vaux 1998; 98; Dolatian 2021). This alternative analysis however has one minor issue and one major issue.

The minor issue is vowel hiatus repair (65). It is common for /u/ to become [v] before vowels. But, this rule of *u*-frication is not a categorical allophonic rule in Armenian, but is highly morphologized (Dolatian 2021; §4.2). This rule applies optionally in some morpheme-morpheme sequences, categorically in others, and never in some sequences.

(65) */u/-[v] frication is morphologically-dependent*

Categorical application		Variable application		Categorical blocking	
lezu	‘language’	gɑdu	‘cat’	otʰɑt͡ʃu	‘pilot’
lezv-ɑgɑn	‘linguistic	gɑdu-ji	‘cat-GEN’	otʰɑt͡ʃu-ji	‘pilot-GEN’
		gɑdv-i	‘cat-GEN’		

Thus if the Armenian child adopts /-u-/ as the UR for the passive, they have to also learn that *u*-frication is categorical for this morpheme. This is a minor issue because the devocalization of /u/ is already highly morphologized in the language. But this minor issue then leads to the major issue on how should the child feasibly deduce that the underlying form of this suffix is /-u-/.

The major issue is that the /-u-/ analysis is significantly abstract. As a native speaker and linguist of Armenian, I doubt that this underlying form /-u-/ can be psychologically real. The passive suffix never alternates on the surface between [-v-] and *[-u-]. Because the Armenian child does not know the diachrony of the passive [-v-], the child has no direct

like CC-PASS. Vaux’s rule-based analysis of schwa epenthesis however does allow for the creation of medial schwas, so we might not need CONTIG-PASS in his system (Vaux 1998; 105ff). However, Vaux’s system does not predict the variation in rhotic metathesis across Western and Eastern Armenian (Vaux 1998; 109); for his system, the clearest strategy is to have a morpheme-specific constraint against rhotic metathesis in the passives of just one dialect, but not the other.

evidence to think the passive [-v-] is underlyingly /-u-/ instead of just /-v-/. Lay speakers and native linguists (as reported in teaching grammars) uniformly label the passive suffix as a consonant [-v-].[23]

Further, the two analyses discussed in this paper (OO-constraints and active-derived truncation) conceptually have more direct evidence than this abstract alternative. For OO-constraints, the child can see that the passive stem matches the active stem (minus the theme vowel). For active-derived truncation, the child again sees that the passive stem is just the active stem minus the theme vowel, along with the other morphosemantic dependencies. Philological grammars on Armenian often note this isomorphism between the active and passive stems (Ղարագյուլյան 1979). In contrast for the abstract UR approach, the child has to guess that the surface [v] could either be underlying /v/ or /u/. If they guess /v/, then they cannot capture the passive phonology, but if they guess /u/, then they *coincidentally* capture the phonology. Such guessing is not directly guided by seeing the stem isomorphism. And as the editor (Michael Kenstowicz, p.c.) cogently reminds us, it is this isomorphism that this paper has argued to be the motivation for the otherwise unexpected opaque phonology in the Armenian passive.

Finally, Armenian already has a handful of consonantal suffixes, such as the nominalizer /-kʰ/, the intensive suffix /-d/, the inchoative morpheme /-n-/, and the aorist suffix /-t͡s-/. Thus, the child is not biased against entertaining underlying consonantal suffixes.

7 Conclusion

This paper focused on determining the cyclic structure of Armenian passives, in so far as that cyclicity causes opacity in the phonology of passives. Active stems display transparent phonological processes because they precede a theme vowel. Although the passive stem precedes a consonantal suffix *-v-*, various phonological processes apply as if the passive stem also preceded a vowel. To capture this paradox, I compute the phonological shape of the passive stem by referencing the phonological shape of the active stem. This dependence can be captured in diverse morphophonological frameworks, summarized in Table 2.

Table 2: Theoretical implementations of the stem dependency for active-passive stems

	Underlying form	Cyclic input to phonology	Morphological structure	Locus of complexity
Affix truncation	/d͡zaɾa-e-v-i-l/	[d͡zaɾaj-] /-v-i-l/	Active-derived	Derivation
Output-output	/d͡zaɾa-v-i-l/	[d͡zaɾa] /-v-i-l/	Root-derived	Architecture
Vowel UR	/d͡zaɾa-u-i-l/	[d͡zaɾa] /-u-i-l/	Root-derived	Representation

[23] As a reviewer suggests, the Armenian situation of an abstract /u/ vs. a surface-apparent /v/ is similar to debates on the Russian /v/ (Padgett 2002).

The approach that I used is that the input to passive phonology is actually active stems and not roots. Alternative strategies are that the input is roots but that either a) we use OO-constraints to reference the active stem, or b) the underlying form of the passive suffix [-v-] is actually a vowel /-u-/. Each of the possible analyses can cover the phonological data, but each has its own weaknesses. Using the active stem as the input requires affix deletion rules, using OO constraints is transderivational and overgenerates, and having an abstract vowel /-u-/ has dubious psychological reality.

Because each analysis has equivalent empirical coverage of the phonological facts, we need non-phonological and conceptual evidence to choose one analysis over the other. Across modules, the active-based analysis correctly predicts that the semantics and morphology also reference active-stems. Such evidence was that passivization is productive, displays a semantic *ABA restriction with roots and active verbs, and that different theme vowels and suffixes interact with truncation. This is cross-modular evidence for the active-based analysis over the other two alternatives.

In sum, to encode this paradox and dependency in a cyclic framework, we need morphological rules that can delete morphs or heads during a cyclic derivation (Trommer 2012). This gives us a derivational trajectory as in (66).

(66) *Derivational pathway of cyclic spell-out with truncation*

Active cycle	→	Passive cycle
Spell-out affix → Phonology	→	Spell-out affix → Delete affix → Phonology

Cyclicity can apply in deriving a bound stem from another bound stem (Bobaljik 1997), not just from free-standing forms (contra traditional OO). Surface morphotactics can contradict underlying morphological structure. And thus we need some level of abstraction. This abstraction (= deleted theme vowels) is warranted because we have cross-modular evidence for it, from phonology, semantics, and morphology.

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