The division of labor between representations and cophonologies in doubly conditioned processes in Amuzgo*

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1. Introduction

This paper introduces a doubly conditioned phonological alternation in Amuzgo (Oto-Manguean) [Southern Mexico], where both a morphologically specific condition and a lexically specific condition must be met for a phonological alternation to surface. We interpret previous frameworks as making distinct specific predictions about the locality restrictions of the two conditioning factors in doubly morphologically conditioned phonology. We test these predictions against the Amuzgo case study.

In cyclic and derivational frameworks, lexically specific information generally disappears after the phonological material belonging to a root is introduced. Thus, any lexical conditions are predicted to be unavailable for interaction with subsequent morphological operations. For example, in level ordering or stratal frameworks like Lexical Phonology (Kiparsky 1982) and Stratal OT, (Bermúdez-Otero 1999, Kiparsky 2000, 2008), doubly conditioned processes are only predicted to be possible if both triggers are introduced at the same level: that is, both are stem-level or both are word-level. So, for a lexically and morphologically conditioned phenomenon, only a level 1, or stem-level affix, should be able to co-trigger a phonological alternation along with a lexical root.

Similarly, in a phase-based spell-out approach such as Embick 2010 or Cophonologies by Phase (Sande and Jenks 2018, Sande 2019, Sande et al. 2020), only two elements introduced within the same syntactic phase domain should be able to co-trigger a process. Sande (2019) specifically discusses this prediction in Cophonologies by Phase, showing that it is borne out in Guébie (Kru). The restrictions on double conditioning persist even where the alternation in question is considered suppletive rather than phonological. In Distributed Morphology, one claim is that suppletive allomorphy can be outwardly conditioned by (adjacent) syntactic features and inwardly conditioned by (adjacent) phonological content

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(Bobaljik 2000). But again, because suppletion involves root-specific information, simultaneous visibility of lexical and syntactic features is only possible at the stage where the relevant root is spelled out.

Here we examine an apparent counterexample to the predicted locality restrictions on double conditioning, observing that the appearance of lexical conditioning may be produced by abstract differences in underlying phonological representation, rather than lexically conditioned phonological processes. To the extent that independent evidence also points to those underlying forms, derivational frameworks are supported over unconstrained alternatives that allow conditions to interact globally across the structure of the word. We contend that where the human language faculty is presented with an impossible case of double conditioning - one where morphological and lexical information seem to jointly condition an alternation, despite being introduced in different lexical strata or phase domains - the currently most restrictive theories on the market must lead the learner to account for the lexical effects by positing abstract differences in underlying representation. Amuzgo presents exactly this kind of case. Based on previous work on Amuzgo, morpheme-specific grammatical tone alternations are sensitive to syntactic phase boundaries (Kim 2018). We pursue a Cophonologies by Phase (CBP) (Sande and Jenks 2018, Sande 2019, Sande et al. 2020) account of seemingly doubly conditioned glottalization patterns in Amuzgo, since syntactic phase boundaries (the domain of phonological evaluation in CBP) seem to be the relevant domain of phonological evaluation in Amuzgo. We argue that the Amuzgo glottalization patterns are not sensitive to phase boundaries in the same way as tonal processes because the former do not involve the stipulation of lexical conditions anywhere in the grammar. The putative lexical effects fall out from the same cophonology, but applied to input forms of different phonological shapes.

All Amuzgo data presented here come from the variety of San Pedro Amuzgos, Oaxaca, as documented by speaker Fermín Tapia García and analyzed by Kim (2016, 2019a,b).

2. Inflectional glottalization alternations in Amuzgo

In Amuzgo, most verb stems are monosyllabic and inflect for person and number via mutations in glottalization, vowel height, and tone. [1] This paper concerns the glottalization alternations, which appear to be jointly conditioned by lexical inflection class and first-person features (Kim 2019b). The pattern is noteworthy because first-person features reside in a relatively high projection, either AGR or the subject DP (for lack of syntactic evidence, we do not take a strong stance on the syntactic position of the subject features), that under standard assumptions should be spelled out in a later phase than the root.

Amuzgo allows six possible syllable rimes. Vowels can be modal, breathy, or laryngealized, and the only possible coda is a glottal stop (Kim 2019b).

[1] The main exception is a class of intransitive verbs that inflect using a system of person/number enclitics, with no stem alternations.

(1) *Syllable rime shapes in Amuzgo*

	Non-laryngealized V		Laryngealized V
No Coda	V	hV	ʔV
Final ʔ	Vʔ	hVʔ	ʔVʔ

Each Amuzgo verb falls into one of five different patterns of inflectional glottalization, which involve alternations in the laryngealized status of the vowel and/or the presence or absence of a glottal-stop coda. In the analysis of Kim (2019b), stems which underlyingly end in a glottal stop (e.g., CVʔ) are arbitrarily specified as falling into either Class 4 or 5. As shown in (2) the difference lies in first-person forms: Class 4 shows glottalization metathesis, where the otherwise final glottal metathesizes into the preceding vowel nucleus. Class 5, on the other hand, shows apparent final vowel epenthesis. The verbs surface with final glottalization in all other forms.

(2) *Inflectional glottalization alternations in Classes 4 and 5*

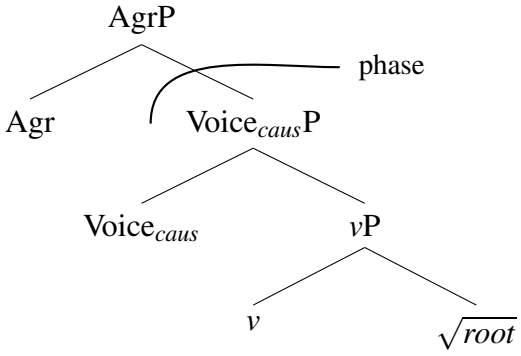
	Class 4	a. 'eat'.CPL	Class 5	b. 'mend'.CPL
1sg/excl/incl	CʔV	tk^{w}ʔa^{HM}	CVʔV	thaʔ^{HM}a^{M}
2sg/pl	CVʔ	tk^{w}aʔ^{L}	CVʔ	thaʔ^{HL}
3sg/pl	CVʔ	tk^{w}aʔ^{M}	CVʔ	thaʔ^{MH}

Kim (2019b) notes that across all classes, there is a general ban on final glottalization in first person contexts. Classes 4 and 5 are therefore analyzed as showing different repairs for avoiding final glottalization in first-person contexts, via cophonologies that are sensitive to the presence of more than one morpheme (along the lines of Sande 2019). Metathesis is produced by a cophonology jointly triggered by first person and a Class 4 lexical specification, while epenthesis results from a Class 5 lexical specification in first-person contexts.

Thus, lexical inflection-class features of the stem and 1st person features in AGR (or in the subject DP) appear to jointly condition the shape of the surface form. However, note that lexical roots and class information are introduced lower in the structure ($\sqrt{}$ or *v*) than person features (AGR) (3).[2]

[2]We remain agnostic as to whether subject person/number features that trigger alternations are introduced on the subject DP or on the AGR node; but it is clear that subject features are introduced above Voice in Amuzgo.

(3) *Causative structure*



Crucially, tonal morphology in Amuzgo indicates the presence of a phase boundary at Voice$_{caus}$, such that AGR and lexical information should not be able to interact. Alongside inflectional glottalization alternations, Amuzgo verbs also participate in tonal inflectional alternations determined by lexical class, as exemplified in (4); these tonal inflection classes are independent of the glottalization ones (Kim 2016). Typically, surface tone melodies on verbs in Amuzgo are determined by the lexical class of the verb, as well as the person and number features of the subject. These are the same morphosyntactic features that determine glottalization patterns.

(4) *Amuzgo verb tones depend on lexical class and subject person/number*

Gloss	a. 'chew'.CPL	b. 'see'.CPL	c. 'hear'.CPL	d. 'arrive'.CPL
1sg	hndɛ L	hnd^{j}ʔia HM	hnd^{j}i HM	t^{j}hɛ L
2sg	hndɛʔ HM	hnd^{j}iaʔ L	hnd^{j}iʔ HM	t^{j}heʔ L
3sg	hndɛ MH	hnd^{j}iaʔ MH	hnd^{j}i MH	t^{j}heʔ MH

However, in causative contexts, the interaction between subject features and lexical class is blocked, and instead the verb surfaces with tones that are predictable based on 3sg tones (claimed to be underlying by Kim 2016). In other words, inflectional tones are no longer doubly conditioned. We take this blocking as evidence that the causative Voice head introduces a phase boundary in Amuzgo, triggering spell-out and preventing future morphosyntactic manipulation of phase-internal material (Chomsky 2000, 2001). Tonal exponence of person/number (5) is either suspended (as in 5b), or determined by non-lexically-specific morphotactic adjustments (as in 5d) (Kim 2018).

(5) *Causative neutralizes subject person/number differences of verb tones*

Gloss	a. 'run'.CPL	b. 'cause to run'.CPL	c. 'sleep'.CPL	d. 'cause to sleep'.CPL
1sg	hna^{M}-nɔ̃ HM	si^{H}-na^{M}-nɔ̃ M	tsɔ L	si^{H}-ki^{H}-tsɔ HM
2sg	hna^{M}-nõʔ L+	si^{H}-na^{M}-nõʔ M	tsuʔ HM	si^{H}-ki^{H}-tsoʔ HM
3sg	hna^{M}-nõ M	si^{H}-na^{M}-nõ M	tso H	si^{H}-ki^{H}-tso H

Unlike for tonal alternations, however, causative does not block the glottalization alternations associated with different persons: the Class 4 (6) versus 5 (7) difference remains in derived causative forms.

(6) si^{H}-ki^{M}-tʔa^{HM} cf. 3sg. si^{H}-ki^{M}-taʔ^{HM}
CAUS-ʔ-begin.CPL
'begin something, 1sg. completive'

(7) si^{H}-nthɔ̃ʔ^{HM}ɔ̃^{M} cf. 3sg. si^{H}-nthõʔ^{HM}
CAUS-unify.CPL
'unify, 1sg. completive'

Despite their similar 3sg shape (CVʔ), Class 4 (6) and 5 (7) verbs have different surface shapes in 1sg contexts even when a causative prefix separates the lexical root from the subject person/number information.

These facts present a problem for the locality predictions of double morphological conditioning made by both suppletive allomorphy and stratal or phase-based frameworks. Both a suppletive allomorphy analysis and a phase-based double-conditioning analysis require hierarchical locality of features that co-condition a phonological process. For a suppletive allomorphy approach, the two conditioning factors must be hierarchically adjacent, which is not true of verbal lexical class features and subject features in causative contexts in Amuzgo (note that there are other verbal prefixes that also intervene between subject and verb, but do not prevent doubly conditioned tonal or glottalization processes). In a phase-based account, the two conditioning factors must be introduced within the same phase domain, since after phonological evaluation of each phase, morphosyntactic features and internal structure of that phase are inaccessible to future instances of evaluation. In causative contexts in Amuzgo, the lexical class features of a verb are introduced in a lower phase domain that the subject features, predicting no possible interaction between the two.

3. Analysis

We show that the locality of doubly conditioned glottalization in Amuzgo is best analyzed not as double morphological conditioning, but as a single morphological trigger (a first person feature) interacting with different underlying representations that correspond to the traditional notion of different lexical classes, specifically, Classes 4 and 5. We show that Cophonologies by Phase can model this type of interaction, alongside true doubly morphologically conditioned effects as modeled in Sande (2019).

Noting that lexical glottalization classes in Amuzgo never have a morphosyntactic or semantic effect, we propose a purely representational difference between classes. Class 4 verbs are argued to be of the underlying form /CVʔ/, with a final glottal stop. Class 5 are argued to be /CVʔV/, with a final vowel.

In first-person contexts across the board, final glottalization is absent, even where the rest of the paradigm has final glottals. Following Kim (2019b:p. 266-267), we propose that in first person contexts only there is a ban on words ending in a glottal stop. This first-person-specific phonological grammar provides a unified account of the behavior of first

person forms across all five lexical classes of verbs. The CBP-style first-person vocabulary item, which maps morphosyntactic to phonological content, is given in (8).

In CBP, morpheme specific cophonologies, $\mathscr{R}$, apply only in the syntactic phase domain in which they are spelled out. Higher phase domains are not subject to the morpheme-specific phonological requirements of elements introduced in lower phase domains. Previously spelled-out material is susceptible to change in higher phase domains, as lower elements are cyclically phonologized inside each successive higher phase domain.

(8) $$\text{1st person} \longleftrightarrow \left\{ \begin{array}{ll} \mathscr{F}: & \emptyset \\ \mathscr{P}: & \emptyset \\ \mathscr{R}: & \textsc{NoCoda}, \textsc{Dep} \gg \textsc{Max} \gg \textsc{Linearity}, \omega = \sigma \end{array} \right\}$$

The vocabulary item in (8) is not associated with any underlying phonological form ($\mathscr{F}$) or prosodic content ($\mathscr{P}$), but is associated with a phonological sub-grammar, or cophonology ($\mathscr{R}$). We implement cophonologies as constraining rerankings in a ranked constraint grammar (Prince and Smolensky 1993/2004).

Glottal stops are the only possible codas in Amuzgo. The constraint ranking in $\mathscr{R}$ in (8) prohibits final codas as well as insertion of additional segments. The low ranking of LINEARITY in first-person contexts ensures that the optimal candidate is the one that avoids a final coda through metathesis, unless the input already lacks a coda.

In phases that do not contain a first person morpheme, the default constraint ranking of MAX, DEP, LINEARITY $\gg$ ω=σ, NOCODA will apply (see Anttila 2002 on 'master rankings' in Cophonology Theory). The derivation for traditional Class 4 verbs–those with the underlying form /CV?/ in our updated account–then becomes quite straightforward.

In causative contexts, the derivation of a 'Class 4' verb proceeds as follows. The lower phase, headed by the causative morpheme, is spelled out first. The default ranking of the language applies because no morpheme inside the causative domain contains a morpheme-specific $\mathscr{R}$. The faithful candidate surfaces as optimal due to the highly ranked faithfulness constraints in the default grammar.

For a root like /si-ki-ta?/, the faithful optimal output of the low causative phase domain /[siki[ta?]]/[3] is the input to the next phase domain, the CP. If the CP contains a first-person morpheme, the first-person $\mathscr{R}$ adjusts the phonological grammar only for the current instance of phonological evaluation. The result is a methathesized optimal output (9).

(9) *Class 4 derivation*

sikita?	NOCODA	DEP	MAX	LINEARITY	ω=σ
a. siki-ta?	*!				
b. siki-ta?a		*!			*
c. ☞siki-t?a				*	
d. siki-ta			*!		

[3]Brackets represent prosodic structure of spelled-out forms.

For traditional Class 5 verbs, those that have the underlying form /CVʔV/ in our analysis, the default ranking will again apply at the lower phase domain and the optimal candidate will be the faithful one. For a Class 5 root like /si-ki-thaʔa/, the faithful [siki[thaʔa]] is optimal.

The faithful optimal output of the lower phase /[siki[thaʔa]]/ becomes the input to the next phase domain, the CP. When the CP contains a first-person morpheme, the first-person grammar applies. In this case, the highly ranked NoCoda has a vacuous effect, since the input candidate is already coda-free. The faithful candidate again surfaces as optimal.

(10) *Class 5 derivation*

sikithaʔa	NoCoda	Dep	Max	Linearity	ω=σ
a. siki-thaʔ	*!				
b. ☞siki-thaʔa					*
c. siki-thʔa			*!		
d. siki-tha			*!*		
e. siki-thaʔaʔ		*!			*

The analysis unifies the metathesis and V/∅ alternations of traditional Class 4 and 5 verbs, capturing the fact that in first person contexts, we never see a final glottal stop.

In 2nd and 3rd person clause domains, the following ranking applies: Linearity, ω=σ ≫ Max, Dep ≫ NoCoda. /CVʔ/ roots surface faithfully as [CVʔ], and /CVʔV/ roots as [CVʔ] due to the high-ranked ω=σ.

For Kim (2018, 2019b) lexically specific co-phonologies differentiated Class 4 versus 5 verbs. However, because at least one phase boundary intervenes, CBP does not predict lexical class information to be accessible during the spell-out of first person features. Instead, we propose an independently motivated difference in underlying form for Classes 4 and 5, which interacts with the co-phonology of the 1st person morpheme. This also allows us to dispense with the notion of a difference in lexical class (at least for 4 and 5) in Amuzgo.

4. Implications and remaining questions

Amuzgo demonstrates that putative morphological and lexical conditions on phonological processes must be examined in morphosyntactic context. Our analysis predicts that there can be two apparent types of doubly morphologically conditioned phonology: (i) true doubly morphologically conditioned phonology, analyzed as two interacting $\mathscr{R}$ specifications within a single phase in CBP, and (ii) a single morpheme-specific phonological requirement interacting differently with different underlying representations. The latter need not be phase-bounded, but interactions across phase boundaries will necessarily involve recognizable phonological operations and constraints, with differences across lexical items attributable to independently necessary differences in underlying representations.

This prediction follows from the architecture of CBP, which guides learners in using morphosyntactic information to resolve otherwise ambiguous divisions of labor across the morphology-phonology interface. We adopt a CBP analysis because CBP accounts for a

wide variety of morphophonological processes, including cross-word effects (Sande et al. 2020) and sub-word effects (Sande 2019), and nicely captures the phase-bounded restriction on double conditioning of tonal alternations in Amuzgo.

Because of the separate components of the vocabulary item in CBP, multiple types of double conditioning are predicted: Interacting rankings ($\mathscr{R}$+$\mathscr{R}$) (Sande 2019), and a morpheme-specific ranking interacting with an underlying form ($\mathscr{R}$+$\mathscr{F}$). Here we provide a concrete example of the latter type, and provide diagnostics to distinguish $\mathscr{R}$+$\mathscr{F}$ from $\mathscr{R}$+$\mathscr{R}$.

Similar cases potentially arise in any language that appears to have inflection classes defined over lexically specified patterns of stem alternations. Future work on morpheme-specific patterns that differ across lexical classes should investigate the morphosyntax of the construction to determine whether a phase boundary intervenes between conditioning factors.

One remaining question comes from some uncertainty among speakers about whether some words pattern as Class 4 versus Class 5 (Buck 2000). A single word can be produced with multiple possible 1sg forms: the 3sg root [ɲõʔ^{HM}] 'make an excuse' can correspond to 1sg [ɲʔõ] or [ɲõʔo]. Under the account where Classes 4 and 5 are simply the result of two different underlying representations, such variation in an individual lexical item is surprising. One possible functional explanation could be uncertainty in UR due to little exposure to defining forms of the paradigm, and a possible formal explanation could be a weak underlying final vowel in Class 5 /CVʔV/ verbs (as per Gradient Symbolic Representations (Smolensky and Goldrick 2016)). Future work will explore these different explanations.

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