AMERINDIA 41: 241-272, 2019

A morphophonological parameter hierarchy for Amuzgo glottalization classes

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Abstract: Inflectional marking of person and number of subject in the verbs of Amuzgo (Eastern Oto-Manguean) involves various stem-internal morphophonological alternations. One such alternation type is in glottalization: stem vowels can alternate between laryngealized, post-glottalized, and plain versions in different paradigm cells. Based on an extensive database of verbal paradigms compiled by native speaker Fermín Tapia García, this paper establishes an inventory of glottalization classes for the San Pedro Amuzgos variety and proposes a hierarchy of morphophonological parameters which define all and only the five productive patterns. The approach follows feature-based analyses of inflectional class structure. I argue that it is possible to posit underlying forms plus a limited set of operations that derive the stem alternations, in a way that develops a theory of internal relationships among the glottalization classes. The proposed analysis makes predictions about natural-class behavior among glottalization classes, as well as impossible paradigm types, which appear to be borne out by the data.

Keywords: inflection clases, features, underlying representations, morphologically conditioned phonology

1. Introduction

Inflectional marking of person and number in Amuzgo, an Eastern Oto-Manguean language of the Oaxaca-Guerrero coastal border region in southern Mexico, involves various stem-internal morphophonological alternations, most notably in glottalization patterns and in tone. Both can be seen in the completive paradigm of the verb -*tʲiʔ*- 'put inside' in (1).

(1) Completive forms of -*tʲiʔ*- 'put inside' (Tapia García n.d.: 720)

1SG	tʲʔi^{53}	1PL.EXCL	tʲʔi^{51}
		1PL.INCL	tʲʔi^{12}
2SG	tʲiʔ^{51}	2PL	tʲiʔ^{1}
3SG	tʲiʔ^{34}	3PL	tʲiʔ^{1}

In (1), the sequencing of the glottalization gesture varies by person category. All of the first-person forms have rimes that consist of laryngealized vowels, transcribed as [ʔi], while second- and third-person forms end in [iʔ], that is, modal vowels followed by a glottal stop. Tones, marked with superscript numbers (1=low, 5=high), also change according to person and number (Kim 2016).

This example illustrates the fact that lexical entries of Amuzgo verbs contain two distinct sets of inflection-class information, one for glottalization and another for tone. The forms in (1) show just one of several possible patterns of paradigmatic alternations in glottalization. Likewise, the tones represent just one of at least 15 possible tonal inflectional classes, whose membership cannot be predicted from other factors. As shown by Kim (2016), the glottalization and tone classes furthermore do not correlate with each other; they are cross-classifying.

Our aim here will be to make some sense of the Amuzgo inventory of glottalization classes, which at first glance may look rather random. We focus on the variety of San Pedro Amuzgos, Oaxaca (ISO 639-3: azg). The only previous characterization of the glottalization classes is found in Buck (2000); a lightly revised version of this is also used in Kim (2016). The analysis presented here is based primarily on an extensive manuscript by Fermín Tapia García, which lists the conjugations of over 1000 verbs and other inflectable roots across person, number, and TAM categories (Tapia García n.d.). Joint review of parts of this manuscript by Tapia García and myself, including proofreading and audio recording, took place in San Pedro Amuzgos in 2012 and 2013. Fieldwork with other native speakers was conducted in 2010, 2012, and 2013, and confirms a high degree of consistency both with Tapia García (n.d.) and with the SIL materials (Stewart & Stewart 2000; Buck 2000).

Table 1 summarizes the full set of productive glottalization patterns found in the data. In the top row, it includes the new class labels that will be proposed in this paper. The table schematizes syllable rimes, which are the locus of the alternations. Since first-person exclusive and inclusive forms never differ in glottalization within a paradigm, for our purposes they will be conflated into a first-person plural (1PL) cell.

Class	a) 1	b) 2	c) 3	d) 4	e) 5
1SG	(ʔ)V	(ʔ)V	ʔV	ʔV	(ʔ)VʔV
2SG	(ʔ)Vʔ	(ʔ)Vʔ	Vʔ	Vʔ	(ʔ)Vʔ
3SG	(ʔ)V	(ʔ)Vʔ	Vʔ	Vʔ	(ʔ)Vʔ
1PL	(ʔ)V	(ʔ)V	ʔV	ʔV	(ʔ)VʔV
2PL	(ʔ)V	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ
3PL	(ʔ)V	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ

Table 1. Amuzgo glottalization classes

The “(ʔ)V” in Classes 1, 2, and 5 should be read as “V or ʔV”: specifically, these three patterns are found both on verbs that have a consistently non-laryngealized vowel (V) throughout the paradigm, and on verbs that have a consistently laryngealized vowel (ʔV). The essence of Classes 1, 2, and 5 lies in the alternating presence and absence of subsequent segments. In contrast, the Class 3 and 4 patterns in Table 1 (c) and (d) are defined by paradigmatic alternations between non-laryngealized and laryngealized vowels.

The main idea of this paper is that the Amuzgo glottalization-class system can be understood in terms of a hierarchy of morphophonological parameters, which define all and only the five productive classes. The approach follows feature-based analyses of inflectional class structure such as Trommer (2008) and Alexiadou & Müller (2008). I argue that it is possible to posit underlying forms plus a limited set of operations that derive the stem alternations, in a way that develops a theory of internal relationships among the glottalization classes.

Two key claims are made. First, we recognize a distinction between lexical and inflectional glottal stops: in other words, glottal stops that are present in underlying representations, as opposed to glottal stops that may be concatenated as part of morphological operations that are specific to certain inflectional classes. This distinction solves some problems in the existing analysis by Buck (2000), where glottalization-class distinctions are defined as sets of operations –including subtractive operations– on third-person stems, which are assumed (erroneously, as will be argued) to represent underlying forms.

Varying patterns of glottal-stop concatenation do not suffice to define all of the glottalization-class distinctions. The second major claim is that glottalization classes are also characterized by differing sets of phonological processes. These results in a sort of dual morphologically conditioned phonology: a phonological process can be triggered not just within a certain morphological construction, but also by a morpholexical inflection-class specification. For example, the distinction between Classes 2 and 3 can be understood as non-application versus application of a glottal dissimilation process. While a greater degree of abstraction may eventually permit analyses of the putative phonological operations as morphologically concatenative (following e.g. Trommer 2011), the analysis presented here indexes different cophonologies (Inkelas & Zoll 2007) to different inflectional classes. In a sense we preserve the insight of Buck (2000) that glottalization classes are characterized by morphophonological operations, but we present a novel view of what the operations are.

The structure of the paper is as follows. Brief background information on the language is provided in §2. In §3, we give an overview of the proposed parameter hierarchy, setting out the division of labor between underlying forms and morphophonological operations in the production of the observed paradigms. In particular, we set up the concept of lexical versus inflectional glottal stops. The following sections provide concrete illustrations of each glottalization class, justifying and formalizing the analysis of morphophonological processes in more detail: §4 focuses on the distinctions among Classes 1, 2, and 3, which cover the underlyingly vowel-final roots, while §5 turns to Classes 4 and 5, which are argued to be the two possible inflectional patterns on underlyingly glottal-final roots. In §6, we conclude by pointing out some successful predictions of the proposed analysis in comparison with Buck (2000) and some other conceivable alternatives.

2. Background on Amuzgo

Amuzgo is spoken by the majority of residents in the municipality of San Pedro Amuzgos, who numbered about 6500 in the 2010 census, although there are signs that it is not being actively acquired by all children. Previous work on Amuzgo of San Pedro Amuzgos includes an SIL dictionary

(Stewart & Stewart 2000) and accompanying sketch grammar (Buck 2000), as well as work by the native speaker linguist Fermín Tapia García with Thomas Smith-Stark, including a dictionary (Tapia García 1999) and analyses of tone (Smith-Stark & Tapia García 1984) and morphosyntax (Smith-Stark & Tapia García 2002).

Throughout the paper, tones will be marked with superscript numbers. The San Pedro Amuzgos variety of Amuzgo has the eight contrastive tones listed and described in (2), of which only the five asterisked ones are exploited for inflectional purposes. The numbers match Smith-Stark & Tapia García's (1984) labelling scheme, with the exception of their <31> tone, which I render as <51> (following Buck's 2000 *alto-bajo* 'high-low' designation, and on the basis of evidence for this representation as argued for by Kim 2016).

(2) Tones of San Pedro Amuzgos Amuzgo

5	high level	35	mid-high rising
53*	high-mid falling	34	mid rising
51*	high-low falling	3*	mid
12*	low rising		
1*	low	* = used in tonal inflection	

In terms of laryngeal phonotactics, Amuzgo allows six types of syllable rimes, shown in (3). A vowel can be modal, breathy, or laryngealized, and the only possible coda consonant is a glottal stop.[1]

(3)

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

Breathy and laryngealized vowels are rendered as hV and ʔV, respectively, in approximate accordance with their phonetics. Like in other Oto-Manguean languages, it is necessary to implement phonation and tone contrasts on a single vowel, but their phonetic incompatibility causes them to be realized in sequence rather than simultaneously: non-modal phonation in the first part of the vowel, then tone in the second (Silverman 1997). Most of our discussion will abstract away from breathiness, which does not play

[1] Nasalized vowels are usually pronounced with an excrescent nasal consonant, e.g. [õm] for /õ/, but these postvocalic nasals are not phonologically contrastive.

an active role in the glottalization class system, and use “V” as a schematization referring to all non-laryngealized vowels.

Two further background notes should be made. Although we concentrate on stem alternations in glottalization, the exponents of person marking additionally include tone, affixation, and vowel-quality alternations, which will be mentioned where relevant but will not receive extended analysis. Also, the person-marking system described in this paper is used with transitive verbs, intransitive verbs with agentive subjects (see Buck 2000: 415ff., Smith-Stark & Tapia García 2002), and in possessive marking in a closed class of closely possessed nouns. In non-agentive intransitive verbs, person inflection uses a different system of marking where no stem alternations are involved.

3. Underlying forms and lexical versus inflectional glottal stops

The goal of this section is to posit underlying root shapes for each glottalization class. The URs serve as a starting point for understanding structural commonalities and differences between the glottalization patterns. The task is nontrivial, since for most classes, there is no immediately obvious null hypothesis as to which shape – if indeed any – is underlying, and which other shapes have been derived from it by morphophonological operations.

Perhaps the best place to start is Class 1, where only the 2SG form differs from the others. The Class 1 column, along with the row showing 2SG forms across classes, is boldfaced in Table 2.

Class	1 - (ʔ)V	2	3	4	5
1SG	**(ʔ)V**	(ʔ)V	ʔV	ʔV	(ʔ)VʔV
2SG	**(ʔ)Vʔ**	**(ʔ)Vʔ**	**Vʔ**	**Vʔ**	**(ʔ)Vʔ**
3SG	**(ʔ)V**	(ʔ)Vʔ	Vʔ	Vʔ	(ʔ)Vʔ
1PL	**(ʔ)V**	(ʔ)V	ʔV	ʔV	(ʔ)VʔV
2PL	**(ʔ)V**	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ
3PL	**(ʔ)V**	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ

Table 2. Class 1 and 2SG forms

For Class 1, a simple "majority rules" metric points to an underlying V or ʔV root. This root surfaces unchanged except in the 2SG form, which adds a glottal stop -*ʔ*. Thus, the only glottalization operation that applies in Class 1 is concatenation of a 2SG suffix -*ʔ*. When we look at the full set of glottalization classes, we additionally observe that the 2SG forms end in a glottal stop across the board. This fact suggests that a 2SG suffix -*ʔ* may be found in all classes, strengthening the case for its existence as an inflectional object. We will adopt the position that the 2SG -*ʔ* is indeed present in all paradigms, even though this turns out not to be a straightforward claim, as discussed shortly.

The remainder of this section will establish a basic distinction between classes where underlying roots are lexically vowel-final (Classes 1, 2, and 3) versus glottal-stop final (Classes 4 and 5). This division, despite being based on phonological rather than morphological criteria, can be thought of as the first parameter that gives structure to the glottalization-class system.

(4) First parameter cut: lexical stem shape

V-final	ʔ-final
|	|
Cl. 1, 2, 3	Cl. 4, 5

Assuming the underlying root shapes in Table 3 – where Classes 1, 2, and 3 have vowel-final roots, while Classes 4 and 5 have glottal stop-final ones – the boldfaced cells in each column indicate the forms in which morphological operation(s) must be responsible for the appearance of an alternation in glottalization pattern.

Class	1 – (ʔ)V	2 – (ʔ)V	3 – ʔV	4 – Vʔ	5 – (ʔ)Vʔ
1SG	(ʔ)V	(ʔ)V	ʔV	**ʔV**	**(ʔ)VʔV**
2SG	**(ʔ)Vʔ**	**(ʔ)Vʔ**	**Vʔ**	Vʔ	(ʔ)Vʔ
3SG	(ʔ)V	**(ʔ)Vʔ**	**Vʔ**	Vʔ	(ʔ)Vʔ
1PL	(ʔ)V	(ʔ)V	ʔV	**ʔV**	**(ʔ)VʔV**
2PL	(ʔ)V	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ
3PL	(ʔ)V	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ

Table 3. Underlying root shapes for each class.

For the V-final roots in Classes 1, 2, and 3, the only possible operations involve insertion of final glottal stops in the 2SG and/or 3SG forms. For the ʔ-final roots in Classes 4 and 5, all and only the first-person forms (in both singular and plural) are derived. Thus, a generalization enabled by this analysis of underlying forms is that the underlying root shape (i.e. whether V-final or ʔ-final) already constrains the possible patterns of stem allomorphy.

An issue that arises at this point is ambiguity about the true stem shape of the 2SG forms in Classes 2-5. To the extent that a 2SG suffix *-ʔ* is hypothesized, it is not clear whether the final [ʔ] in these forms is due to a ʔ-final stem, or to the 2SG suffix. Evidence that the 2SG stems can still be analyzed as ʔ-final, independently of the 2SG suffix, comes from tonal inflection. The data in (5) show the two most common patterns of tonal inflection in singular paradigms. Together, these surface patterns account for over half of all sampled paradigms in Kim (2016), but they are in complementary distribution: (5a) is found only on verbs whose 3SG forms are vowel-final (i.e. glottalization class 1), while (5b) is found only on verbs whose 3SG forms are ʔ-final (i.e. glottalization classes 2-5).

(5) Tonal evidence for stem-final glottal stops in 2SG forms:

	a. Default tones, Class 1		b. Default tones, Classes 2-5	
1SG	tã^{53}	<53>	tʔã^{53}	<53>
2SG	tãʔ^{53}	<53>	tãʔ^{51}	<51>
3SG	tã^{34}		tãʔ^{51}	
	‘smell, inhale’ (completive)		‘break, split’ (completive)	

Kim (2016) analyzes both patterns in (5) as reflexes of the same underlying morphological tones, which surface faithfully in pattern (5a). Allotony in 2SG forms arises due to a “double glottal” context –the concatenation of the 2SG suffix *-ʔ* onto a stem that is already *ʔ*-final. In both patterns, (5a) and (5b), the first-person tone is <53>. In the second person, we observe complementary distribution: <53> is only found in Class 1 verbs, while <51> is exclusive to the remaining glottalization classes. This type of allotony is attested more broadly across the tonal inflectional system: only <51> and <1> are attested as 2SG tones in glottalization classes 2-5. Meanwhile, <51> is never observed as a surface 2SG tone in words whose 3SG form ends in a vowel. Similarly, neither <53> nor <3> ever appear as second-person tones in words whose 3SG form ends in a glottal stop, despite the wide occurrence of both as 2SG tones for glottalization Class 1.

Based on this complementary distribution, Kim (2016) posits a rule of Tone Lowering, whose operation is schematized in (6). The rule allows 2SG tones <51> and <1> to be derived phonologically from underlying morphological tones <53> and <3>, respectively.

(6) Tone Lowering
$[_{\text{Stem}}$ CVʔ$^{(5)3}$]-ʔ → CVʔ$^{(5)1}$

The rationale for the abstract double-glottal structure, where a stem-final glottal stop meets a 2SG suffixal glottal stop, is that it is the only phonological context that could plausibly trigger this phonological alternation in a way that is unique to the 2SG forms of Classes 2-5, while successfully excluding other forms that end in a glottal stop (such as 3SG forms, or the 2SG forms of Class 1 words). The revised material in Table 4 shows how the 2SG forms of Classes 2-5 can end up with a common phonological environment if we posit an “inflectional glottal stop” (distinct from the 2SG suffix) that is added to 2SG and 3SG forms in Classes 2 and 3.

Class	1	2	3	4	5
UR	(ʔ)V	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ
1SG	(ʔ)V	(ʔ)V	ʔV	ʔV	(ʔ)Vʔ$_{\text{lex}}$V
2SG	(ʔ)V-ʔ$_{\text{2sg}}$	**(ʔ)Vʔ$_{\text{infl}}$-ʔ**$_{\text{2sg}}$	**Vʔ$_{\text{infl}}$-ʔ**$_{\text{2sg}}$	**Vʔ$_{\text{lex}}$-ʔ$_{\text{2sg}}$**	**(ʔ)Vʔ$_{\text{lex}}$-ʔ$_{\text{2sg}}$**
3SG	(ʔ)V	**(ʔ)Vʔ$_{\text{infl}}$**	**Vʔ$_{\text{infl}}$**	Vʔ$_{\text{lex}}$	(ʔ)Vʔ$_{\text{lex}}$
1PL	(ʔ)V	(ʔ)V	ʔV	ʔV	(ʔ)Vʔ$_{\text{lex}}$V
2PL	(ʔ)V	(ʔ)V	ʔV	Vʔ$_{\text{lex}}$	(ʔ)Vʔ$_{\text{lex}}$
3PL	(ʔ)V	(ʔ)V	ʔV	Vʔ$_{\text{lex}}$	(ʔ)Vʔ$_{\text{lex}}$

Table 4. Sources of postvocalic glottal stops

The inflectional glottal stop (ʔ$_{\text{infl}}$) is already attested on the 3SG forms in Classes 2 and 3. If it also attaches to the 2SG forms in those same classes, in addition to the separate 2SG suffix -ʔ, then we are able to derive the same phonological shape as in the 2SG forms of Classes 4-5, where the double-glottal structure has a different morphological source –namely the juxtaposition of a lexical stem-final glottal stop with the 2SG suffix. We should note that no phonetic difference between single and double final glottal stops has been observed. Presumably, a phonological double glottal stop is realized as a regular single glottal stop on the surface, leaving traces only via conditioning of tone. Alternatively, the 2SG suffix could be reanalyzed as having a tonal allomorph that subcategorizes for ʔ-final stems, such that the common structure across Classes 2-5 can be derived without necessarily positing an abstract double-glottal structure.

The consequence of the allotony, in any case, is that we can consider the 2SG forms in Classes 2-5 to have ʔ-final stems. Under this view, Table 4 shows that stem alternations in glottalization (where present, and if defined as excluding the 2SG suffix) always split first-person forms from second- and third-person forms in the paradigm.

It is now possible to elaborate the parameter hierarchy further. Within the V-final roots (7a), an inflectional glottal stop parameter separates Class 1 from Classes 2 and 3. A further process of laryngeal dissimilation in Class 3 serves to distinguish the latter pair; this parameter will be described in detail in §4. Turning to Classes 4 and 5 in (7b), they can be analyzed as instantiating different repair strategies for satisfying a phonological constraint against first-person forms ending in glottal stop; these will be discussed in §5.

(7)a. V-final
- Cl. 1
- Inflectional glottal
  - Cl. 2
  - Dissimilation
Cl. 3

b. ʔ-final
- ʔ-Metathesis
Cl. 4
- V-Epenthesis
Cl. 5

A persistent issue will be to justify this particular division of labor between underlying forms and morphophonological operations. For example, what prevents us from reversing the inflectional-glottal analysis of Classes 2 and 3, and proposing deletion operations in the 1SG and all plural forms? Aside from the theoretical problem that the 1SG and all plurals form a rather implausible natural class in terms of morphosyntactic features, we have independent evidence that final glottal stops in 2SG/3SG forms can be morphological elements rather than lexically underlying. This evidence comes from words that are attested in both uninflected and inflected forms, so we can recover the phonological shape of the underlying root from outside the inflectional system. This set of words includes closely possessed nouns, which are inflected for possession using the same person-marking system as transitive verbs, but which also appear freely in unpossessed form.

The examples in Table 5 show some nouns that are vowel-final in their uninflected forms (treated as base in the table). In possessive forms, however, Buck (2000: 400) reports that the 3SG acquires a final glottal stop (in addition to tonal changes). The full conjugations in Tapia García (n.d.) confirm that this added glottal stop is absent from the 1SG and all plural forms, while being present in the 3SG as well as in the 2SG (as deduced from tonal evidence).

	Base	1SG	2SG	3SG	3PL	
a.	ndia^{5}	ndia^{53}	ndiaʔ^{51}	ndiaʔ^{5}	ndia^{5}	‘clothes’
b.	n̥dʲe^{1}	n̥dʲɛ^{12}	n̥dʲeʔ^{1}	n̥dʲeʔ^{12}	n̥dʲe^{12}	‘air; voice’
c.	tʃu^{3}	tʃu^{53}	tʃuʔ^{51}	tʃuʔ^{34}	ndʲu^{34}	‘year; age’
d.	sʔõ^{53}	sʔɔ̃^{53}	sʔõʔ^{51}	sʔõʔ^{34}	sʔõ^{34}	‘money’
e.	tʃʔẽ^{3}	(unknown)	(unknown)	tʃʔẽʔ^{34}	(unknown)	‘patio’

Table 5. Unpossessed and possessed nouns

The possessive paradigms of (a-d) thus fit exactly into the Class 2 glottalization paradigm. Because the words are attested in their uninflected forms as vowel-final, the addition of inflectional glottal stops in the 2SG and 3SG is more transparent here than it is for other Class 2 words where there is no direct evidence for the shapes of uninflected forms. For (e), only the uninflected and 3SG forms are given by Buck (2000: 400), and the word is not found in Tapia García (n.d.).; however, it is given to support (d) as another example of a possessive glottal stop on a word with a laryngealized vowel.

Another morphological construction where we have evidence for Class 2 paradigms built on vowel-final underlying forms is found in property concept predication. This is shown in Table 6. The word in (a) appears to have a nominal abstract meaning in uninflected form, but requires person inflection to be predicated of an argument.

	Base	1SG	2SG	3SG	3PL	
a.	tẽ^{3}	tɛ̃^{3}	tẽʔ^{51}	tẽʔ^{34}	tẽ^{34}	‘be cold’
b.	(unknown)	n^{5}nkia^{53}	n^{5}nkiaʔ^{51}	n^{5}nkiaʔ^{5}	n^{5}nkia^{5}	‘be fearful’
c.	(unknown)	nɛ̃^{12}	nẽʔ^{1}	nẽʔ^{12}	nẽ^{12}	‘be happy’

Table 6. Uninflected and inflected property concepts.

While the majority of property concepts do not use the agentive inflectional system described in this paper, Buck (2000: 413-414) gives a short list of “physical and emotional characteristics” that belong to our Class 2; all have a final glottal stop in their 2SG and 3SG forms. The words in (b) and (c) are not found in uninflected form in my sources, but they are given to exemplify the robust attestation of the Class 2 glottalization pattern with property concepts; their morphological properties (e.g. failure to take present-tense prefixes) suggest that they are indeed nominal, and derived from a more basic root along the lines of the pattern in Table 5 and (a) of Table 6. In light of recent cross-linguistic work on possessive strategies of property concept predication (e.g. Koontz-Garboden & Francez 2010; Francez & Koontz-Garboden 2015), these paradigms are likely to simply also be possessive, but they can be mentioned for their value as a non-obvious source of further data on paradigms whose base is potentially attested in uninflected form.

In sum, the possessive paradigms show that a morphological operation adding final glottal stops to 2SG/3SG forms is independently attested in Amuzgo. This same process appears to unify the Class 2 and 3 glottalization paradigms, where only the 2SG and 3SG forms differ in stem shape from other cells in being ʔ-final, whereas the 1SG and all plural cells have V-final forms.

Moving to Classes 4 and 5, a structural relationship between them is similarly suggested by the fact that in both paradigms, the first-person forms are the odd ones out. Table 4, repeated here as Table 7 this time, boldfacing highlights the cells that have undergone a glottalization change from the hypothesized underlying form.

Class	1	2	3	4	5
UR	(ʔ)V	(ʔ)V	ʔV	Vʔ	(ʔ)Vʔ
1SG	(ʔ)V	(ʔ)V	ʔV	**ʔV**	**(ʔ)Vʔ$_{lex}$V**
2SG	(ʔ)V-ʔ$_{2sg}$	**(ʔ)Vʔ$_{infl}$-ʔ$_{2sg}$**	**Vʔ$_{infl}$-ʔ$_{2sg}$**	Vʔ$_{lex}$-ʔ$_{2sg}$	(ʔ)Vʔ$_{lex}$-ʔ$_{2sg}$
3SG	(ʔ)V	**(ʔ)Vʔ$_{infl}$**	**Vʔ$_{infl}$**	Vʔ$_{lex}$	(ʔ)Vʔ$_{lex}$
1PL	(ʔ)V	(ʔ)V	ʔV	**ʔV**	**(ʔ)Vʔ$_{lex}$V**
2PL	(ʔ)V	(ʔ)V	ʔV	Vʔ$_{lex}$	(ʔ)Vʔ$_{lex}$
3PL	(ʔ)V	(ʔ)V	ʔV	Vʔ$_{lex}$	(ʔ)Vʔ$_{lex}$

Table 7. Relationship of underlying and derived stems across classes

There is some evidence that Classes 4 and 5 instantiate parallel inflectional possibilities for the same underlying root shapes. Buck (2000: 384) reports that a handful of lexical items show interspeaker variation, falling into the equivalents of Class 4 for some speakers and Class 5 for others. For example, the verb 'make an excuse' in its 3SG incompletive form is *ʔ-ɲ̥õʔ* (8a), with a glottal-final CVʔ stem shape.[2] It has two possible first-person forms, given in (8b-c); the original source does not provide tones.

(8) Variation in 1SG forms of 'make an excuse', incompletive (Buck 2000: 384)

	a.	3SG	ʔ-ɲ̥õʔ^{35}		CVʔ	
	b.	1SG	ɲ̥ʔɔ̃		CʔV	
or	c.	1SG	ɲ̥ɔ̃ʔ	(presumably ɲ̥ɔ̃ʔɔ̃)	CVʔ	(presumably CVʔV)

The form in (8b) represents a Class 4 paradigm, while the form in (8c) is indicative of Class 5. In Stewart & Stewart (2000), the dictionary that accompanies Buck (2000), the plural stem of the lexical item in (8), *ko*^{3}-*ɲ̥õʔ*^{35} 'make an excuse', is also listed as ambiguous in its first-person glottalization pattern between Class 4 and Class 5-like shapes, although the forms themselves are not given. The reinterpetation of the original-source form in (15c) as CVʔV is due to the fact that first-person CVʔ stems in the paradigms in Buck (2000) correspond consistently to CVʔV forms in Tapia García (n.d.). While interspeaker variation as the source of the discrepancy cannot be ruled out, all data directly observed by me so far has pointed to the CVʔV pattern, where the second vowel is an echo vowel. The echo vowel is prosodically weak: it is impressionistically very short in duration, low in intensity, and probably phonologically toneless (i.e. usually pronounced in the middle of the pitch range but never having a phonologically distinctive tonal target).

In any case, the variation in (8) is unsurprising under our theory of the glottalization-class system. Because underlying root shape limits the set of possible glottalization paradigms, as visualized in (4) and (7), the variant forms in (8b-c) represent the only two possible first-person stem shapes for an underlying CVʔ root, even in the absence of any inflection-class

2 The initial *ʔ*- is a prefix consistently found across 3SG incompletive forms of all glottalization classes. It is transcribed as a glottal stop by Tapia García (n.d.), but rendered orthographically as a prefix *i*- in the SIL materials, since the glottal stop is usually realized with a very short voiced release that tends to have an [i]- or [e]-like quality.

information. Particularly since Class 4/5 ambiguity is the only kind of glottalization variation described by Buck (2000), the variation can likely be taken to indicate some structural affinity between the two classes. Two additional cases of variation resulting in apparently mixed paradigms, with Class 4-like singulars but variation between Class 4- and Class 5-like plurals, are discussed further in §5 below.

Having set out some arguments for a division between V-final glottalization classes 1-3 and ʔ-final classes 4 and 5, we now turn to each of these in more detail.

4. Vowel-final classes and the dissimilation parameter

The purpose of this section is to provide concrete examples of paradigms from Classes 1, 2, and 3, and to explore the source of the Class 2/3 distinction in more detail. I will argue that the Class 3 pattern is exclusive to roots with -ʔV rimes, i.e. underlyingly laryngealized vowels, and that these roots are distinguished from Class 2 roots with -ʔV rimes via their specification for a glottal dissimilation process whereby a laryngealized vowel loses its laryngealization in the context of a following glottal stop. (9a) states this process in a traditional rule-based format and in terms of the "ʔV" orthography for laryngealized vowels. An autosegmental formulation is given in (9b), which illustrates the delinking of the feature [+constricted glottis] in this configuration.

(9) Laryngeal dissimilation rule specific to Class 3
a. ʔV→ V / _ʔ
b.
$$\begin{array}{cc} V & ʔ \\ \nparallel & | \\ [+c.g.] & [+c.g.] \end{array}$$

Table 8, which includes only laryngealized-rime words in the vowel-final classes, shows that under this analysis, Classes 2 and 3 are identical in terms of the concatenation of the inflectional glottal stop in 2SG and 3SG. The difference in Class 3 is that dissimilation applies to the inflected form, resulting in the observed Vʔ rather than ʔVʔ rimes.

Class	1	2	3
UR	ʔV	ʔV	ʔV
1SG	ʔV	ʔV	ʔV
2SG	ʔV-**ʔ**$_{\mathbf{2sg}}$	ʔV**ʔ**$_{\mathbf{infl}}$**-ʔ**$_{\mathbf{2sg}}$	/ʔV**ʔ**$_{\mathbf{infl}}$**-ʔ**$_{\mathbf{2sg}}$/ → Vʔ$_{\mathrm{infl}}$-ʔ$_{\mathrm{2sg}}$
3SG	ʔV	ʔV**ʔ**$_{\mathbf{infl}}$	/ʔV**ʔ**$_{\mathbf{infl}}$/ → Vʔ$_{\mathrm{infl}}$
1PL	ʔV	ʔV	ʔV
2PL	ʔV	ʔV	ʔV
3PL	ʔV	ʔV	ʔV

Table 8. -ʔV rimes across vowel-final classes

To start by illustrating the simplest set of cases, examples of Class 1 paradigms are given in (10). In (10a) we have the completive paradigm of ‘sing’, with a modal vowel, and in (10b) we have the completive paradigm of ‘rip, break’, with a laryngealized vowel.

(10) Class 1 paradigms:

a. Class 1 (CV) ‘sing’, completive (Tapia García n.d.: 431)[3]

1SG	ta^{53}	CV	1PL.INCL	ta^{12}	CV
			1PL.EXCL	ta^{51}	CV
2SG	ta-ʔ^{3}	CV	2PL	ta^{1}	CV
3SG	ta^{3}	CV	3PL	ta^{1}	CV

b. Class 1 (CʔV) ‘rip, break’, completive (Tapia García n.d.: 543)[4]

1SG	tʔiɔ^{53}	CʔV	1PL.INCL	tʔiɔ^{34}	CʔV
			1PL.EXCL	tʔiɔ^{51}	CʔV
2SG	tʔio-ʔ^{3}	CʔV	2PL	tʔio^{3}	CʔV
3SG	tʔio^{1}	CʔV	3PL	tʔio^{3}	CʔV

In both (10a) and (10b), the only glottalization change consists of 2SG -ʔ suffixation. Although the suffix is included in the actual forms, it is omitted from the accompanying stem-shape templates. In plural forms, second and third person are normally disambiguated with pronominal enclitics *oʔ*^{3} (2PL) and *ho*^{5} (3PL), which are omitted here in order to focus on the stem shapes.

Amuzgo has a pervasive system of initial consonant mutations between singular and plural stems, described in depth by Buck (2000). It is worth

3 As mentioned, in the stem-shape templates, non-larygealized nuclei, i.e. oral and breathy monophthongs or diphthongs, will be represented as V. Similarly, initial C refers either to singleton onsets or onset clusters.

4 Lowering of high-mid vowels to low-mid is a regular process in first person forms.

observing that the segmental alternations do not appear to interact with glottalization phonotactics. This can be seen in (11a) with a CV root, and in (11b) with a CʔV root.

(11) Class 1 paradigms with singular-plural consonant alternation:

a. Class 1 (CV) ‘sweep’, completive (Tapia García n.d.: 663)

1SG	tka^{53}	CV	1PL.INCL	ta^{34}	CV
			1PL.EXCL	ta^{51}	CV
2SG	tka-ʔ^{53}	CV	2PL	ta^{3}	CV
3SG	tka^{1}	CV	3PL	ta^{3}	CV

b. Class 1 (CʔV) ‘steal, pinch’, completive (Tapia García n.d.: 20)[5]

1SG	ʃʔuɛ^{53}	CʔV	1PL.INCL	ɲ̥dʲʔuɛ^{35}-ɛ^{5}	CʔV
			1PL.EXCL	ɲ̥dʲʔuɛ^{51}	CʔV
2SG	ʃʔue-ʔ^{53}	CʔV	2PL	ɲ̥dʲʔue^{35}	CʔV
3SG	ʃʔue^{35}	CʔV	3PL	ɲ̥dʲʔue^{35}	CʔV

Buck (2000: 427) also describes some semiproductive, and in some cases very specifically conditioned, rules of vowel lowering and diphthongization to derive plural from singular stems. These semiregular vowel alternations do not appear to disrupt glottalization in Class 1 verbs, for example in (12) where the singular nucleus in *-ʔui* lowers to *-ʔue* ‘touch, grab’ in the plural.

(12) Class 1 (CV) ‘touch, grab’, completive (Tapia García n.d.: 338)

1SG	tʔui^{53}	CʔV	1PL.INCL	tʔuɛ^{12}	CʔV
			1PL.EXCL	tʔuɛ^{51}	CʔV
2SG	tʔui-ʔ^{53}	CʔV	2PL	tʔue^{1}	CʔV
3SG	tʔui^{35}	CʔV	3PL	tʔue^{1}	CʔV

On the other hand, the nucleic alternation in the singular-plural pair *βʔi* ~ *βhe* ‘to get angry’ in (13) is not more generally attested, and vowel laryngealization disappears in the plural. It is possible that irregular glottalization changes such as these can be developed into a diagnostic to separate morphophonologically related pairs of singular-plural stems from

5 First-person echo vowels are found in the absence of stem-final glottal stop in two contexts that do not appear to be related to glottalization classes: with the relatively uncommon first-person singular inflectional tone <51>, and in some first-person plural forms (inclusive only), as is the case here, the pattern behind which is not clear to me. Glottally conditioned echo vowels, on the other hand, occur in both the inclusive and exclusive first-person plurals, and regardless of tone. Echo vowels occur in even more contexts in well-defined functions, e.g. to mark definiteness, so they may have multiple unrelated sources. In any case, their appearance with first-person glottal-final stems in Class 5 is systematic, but this example should not be conflated with the Class 5 phenomenon.

suppletive pairs, in cases where marginal segmental similarities leave room for doubt.

(13) Class 1 (CV) ‘get angry’, incompletive (Tapia García n.d.: 48)

1SG	βʔi^{53}	CʔV	1PL.INCL	βhɛ^{35}-ɛ^{5}	CV
			1PL.EXCL	βhɛ^{51}	CV
2SG	βʔi-ʔ^{53}	CʔV	2PL	βhe^{35}	CV
3SG	βʔi^{35}	CʔV	3PL	βhe^{35}	CV

Some Class 2 paradigms, with the inflectional glottal stop in 2SG and 3SG forms, are given in (14). The paradigm in (14a) has a modal vowel, and (14b) has a laryngealized vowel. An orthogonal difference is that the paradigm in (14a) is verbal, while (14b) shows possessive forms of *sʔõ*^{34} ‘money’, which as we can see lacks the inflectional glottal stop in its uninflected form.

(14) Class 2 paradigms

a. ‘receive a gift’, completive (Tapia García n.d.: 24)

1SG	n̥da^{3}	CV	1PL.INCL[6]	n̥da^{34}a^{5}	CV
			1PL.EXCL	n̥da^{51}	CV
2SG	n̥daʔ^{51}	CVʔ	2PL	n̥da^{34}	CV
3SG	n̥daʔ^{34}	CVʔ	3PL	n̥da^{34}	CV

b. *sʔõ*^{34} ‘money’, possessive (Tapia García n.d.: 77)

1SG	sʔɔ̃^{53}	CʔV	1PL.INCL	sʔɔ̃^{34}	CʔV
			1PL.EXCL	sʔɔ̃^{51}	CʔV
2SG	sʔõʔ^{51}	CʔVʔ	2PL	sʔõ^{34}	CʔV
3SG	sʔõʔ^{34}	CʔVʔ	3PL	sʔõ^{34}	CʔV

The last type of vowel-final paradigm is Class 3, which has a similar “Inverted-L” paradigm to Class 2, where 2SG and 3SG are the odd cells out and the 1SG together with plural cells can be thought of as forming an upside-down L shape. In (15), the addition of stem-final glottal stops in the 2SG and 3SG forms is accompanied by loss of laryngealization on the vowel, such that the combination of CʔV + inflectional glottal stop turns out as CVʔ. This pattern is only evident on roots with underlying -ʔV nuclei for the simple reason that dissimilation cannot manifest itself in the absence of any vowel laryngealization that could dissimilate.

6 This form is listed in Tapia García with a first-person inclusive echo vowel of the type mentioned in fn. 5.

(15) Class 3 paradigm ‘heat oneself (with fire)’; all forms followed in usage by *tʃõ*^{1} ‘fire’ (Tapia García n.d.: 442)

1SG	tʔɔ̃^{53}	CʔV	1PL.INCL	tʔɔ̃^{12}	CʔV
			1PL.EXCL	tʔɔ̃^{51}	CʔV
2SG	/tʔõʔ/ → tõʔ^{51}	CVʔ	2PL	tʔõ^{12}	CʔV
3SG	/tʔõʔ/ → tõʔ^{34}	CVʔ	3PL	tʔõ^{12}	CʔV

The phonotactic stability of glottalization in the face of initial consonant mutations (16a) and vowel-lowering alternations (16b) can be appreciated in the respective paradigms. The forms in (16b) contain the completive prefix allomorph *tʲi*^{3}- in lieu of initial consonant mutations.

(16) Glottal stability with segmental alternations in Class 3

a. ‘urinate’, completive (Tapia García n.d.: 17)

1SG	ʃʔiu^{53}	CʔV	1PL.INCL[7]	ɲ̥dʲʔiu^{34}-u^{5}	CʔV
			1PL.EXCL	ɲ̥dʲʔiu^{51}	CʔV
2SG	ʃiuʔ^{51}	CVʔ	2PL	ɲ̥dʲʔiu^{12}	CʔV
3SG	ʃiuʔ^{35}	CVʔ	3PL	ɲ̥dʲʔiu^{12}	CʔV

b. ‘play’, completive (Tapia García n.d.: 1201)

1SG	tʲi^{3}-ŋkʲʔu^{53}	CʔV	1PL.INCL	tʲi^{3}-ŋkʲʔɔ^{12}	CʔV
			1PL.EXCL	tʲi^{3}-ŋkʲʔɔ^{51}	CʔV
2SG	tʲi^{3}-ŋkʲuʔ^{51}	CVʔ	2PL	tʲi^{3}-ŋkʲʔo^{12}	CʔV
3SG	tʲi^{3}-ŋkʲuʔ^{5}	CVʔ	3PL	tʲi^{3}-ŋkʲʔo^{12}	CʔV

In singular forms, Class 3 has in common with Class 4 that first-person CʔV alternates with second-/third-person CVʔ; indeed, this commonality led to their being conflated in the SIL analysis of the glottalization classes. The similarity can be verified with a brief look back at Table 7. Nevertheless, there are a couple of arguments in favor of the analysis where there is an underlyingly laryngealized vowel that loses its laryngealization upon the addition of the 2SG/3SG inflectional glottal stop.

First, if surface CVʔ is the realization of underlying /CʔVʔ/, we should never see breathy vowels in Class 3 paradigms. This prediction is borne out in the available data. Breathiness and laryngealization are incompatible (as we saw in §2), and there is no evidence that they cooccur even on an abstract level, so the hypothesis that all Class 3 roots are underlyingly CʔV should preclude the inclusion of any breathy vowels in this group. On the other

[7] This form is listed in Tapia García with a first-person inclusive echo vowel of the type mentioned in fn.5.

hand, if there was no morphophonological relationship between stem allomorphs, there would be no reason why laryngealized and breathy vowels fail to alternate with each other.

Second, there are uninflected nouns of shape CʔV whose possessive paradigms fall into Class 3. Some examples are given in (17). Unlike Class 2 possessives such as (d) in Table 5 and (14b), they lose vowel laryngealization in the 2SG and 3SG forms. All plural forms then revert to the CʔV stem shape.

(17) Class 3 possessive paradigms

a. $βʔa^{5}$ 'house' (Tapia García n.d.:17)

1SG	$βʔa^{53}$	CʔV	1PL.INCL	$βʔa^{5}$-a^{5}	CʔV
			1PL.EXCL	$βʔa^{51}$	CʔV
2SG	$βaʔ^{51}$	CVʔ	2PL	$βʔa^{5}$	CʔV
3SG	$βaʔ^{5}$	CVʔ	3PL	$βʔa^{5}$	CʔV

b.[8] -$sʔa^{1}$ 'male; husband'

1SG	$sʔa^{12}$	CʔV	1PL.INCL	$sʔa^{12}$-a^{5}	CʔV
			1PL.EXCL	$sʔa^{51}$	CʔV
2SG	$saʔ^{1}$	CVʔ	2PL	$sʔa^{12}$	CʔV
3SG	$saʔ^{12}$	CVʔ	3PL	$sʔa^{12}$	CʔV

It is unclear what causes a CʔV word to be assigned to Class 2 as opposed to Class 3. Nevertheless, the unity of the possessive constructions would be lost if they could not both be described in terms of the addition of the inflectional glottal stop to the 2SG and 3SG forms.

It must be conceded that the evidence from uninflected forms of possessable words is not perfect. Some words with Class 3 possessive paradigms are independently attested in uninflected CVʔ shapes, like in (a) in Table 9, or even CV shapes (b-c). Glosses are given separately for uninflected and inflected forms.

8 In the bare form as cited, this root requires an age-appropriate classifier prefix, surfacing in forms such as *ju*^{5}-*sʔa*^{1} 'boy' or *tsã*^{3}-*sʔa*^{1} 'man', but the point is that it is attested in uninflected form. In inflected (possessive) form, it means 'husband'.

	Base		1SG	3SG	3PL	
a.[9]	tsuaʔ^{1}	‘gourd, cup’	tsʔua	tsuaʔ^{12}	ntʔua^{12}	‘animal shell’
b.	ja^{1}	‘good’	jʔa^{12}	jaʔ^{12}	jʔa^{12}	‘in good health’
c.	n̥ã^{51}	‘shame’	n̥ʔã^{12}	n̥ãʔ^{12}	n̥ʔã^{12}	‘ashamed’

Table 9. Class 3 with mismatches between uninflected and 1SG/plural stems

On the other hand, the meaning correspondences between the uninflected and inflected forms in Table 9 (a-b) are not entirely transparent, having been subject to some lexicalization, so the possibility that the inflected forms are built on a derived stem cannot be ruled out.

In spite of these open questions, we have seen that Classes 2 and 3 are unified by their “inverted-L” shape, caused by a 2SG/3SG inflectional glottal stop. Class 3 goes one step further in implementing the rule in (9), giving rise to further changes in 2SG/3SG forms.

5. Glottalization classes as phonological repairs

Progressing through the glottalization paradigm table, we now move on to Classes 4 and 5, hypothesized to be built on ʔ-final roots.

Class	4	5
UR	Vʔ	(ʔ)Vʔ
1SG	**ʔ$_{lex}$V**	**(ʔ)Vʔ$_{lex}$V**
2SG	Vʔ$_{lex}$-ʔ$_{2sg}$	(ʔ)Vʔ$_{lex}$-ʔ$_{2sg}$
3SG	Vʔ$_{lex}$	(ʔ)Vʔ$_{lex}$
1PL	**ʔ$_{lex}$V**	**(ʔ)Vʔ$_{lex}$V**
2PL	Vʔ$_{lex}$	(ʔ)Vʔ$_{lex}$
3PL	Vʔ$_{lex}$	(ʔ)Vʔ$_{lex}$

Table 10: Glottal-final classes

A small addition has been made to Table 10, namely the designation of the laryngealization in Class 4 first-person forms as being lexical. This section will develop an analysis of the first-person alternations as being driven by a phonological requirement prohibiting first-person forms from ending in a glottal stop. Classes 4 and 5 differ in how they satisfy this requirement: in

9 The tone of the 1SG form is unknown; the segments are constructed on the basis of the morphological information in Stewart & Stewart (2000), but the full paradigm is not available.

Class 4, the feature [+constricted glottis] alters its linearization to dock on the vowel, causing it to become laryngealized, while Class 5 epenthesizes an echo vowel after the potentially offending root-final glottal stop.

This analysis extends the same architectural idea developed for Class 3, which is that different sets of phonological operations (cophonologies) can be indexed to different sets of lexical items to define different inflectional classes. The psychological reality of a phonological conspiracy triggered by first-person morphological features is not directly testable within the scope of this paper, but the "conspiracy" analysis does enable some insights, highlighted below, that are not afforded by alternative analyses.

Some Class 4 paradigms are shown in (18), a verb in (18a) and a possessed noun in (18b). The uninflected form of the noun in (18b), if any, is unknown.

(18) Class 4: First-person glottalization metathesis

a. CVʔ 'begin', completive (Tapia García n.d.:434)

1SG	tʔa^{53}	CʔV	1PL.INCL	tʔa^{12}	CʔV
			1PL.EXCL	tʔa^{51}	CʔV
2SG	taʔ^{51}	CVʔ	2PL	taʔ^{1}	CVʔ
3SG	taʔ^{53}	CVʔ	3PL	taʔ^{1}	CVʔ

b. CVʔ 'throat, neck' (Tapia García n.d.:1020)

1SG	ʃtʲʔɔ^{53}	CʔV	1PL.INCL	ki^{3}-tʲʔɔ^{12}	CʔV
			1PL.EXCL	ki^{3}-tʲʔɔ^{51}	CʔV
2SG	ʃtʲoʔ^{51}	CVʔ	2PL	ki^{3}-tʲoʔ^{1}	CVʔ
3SG	ʃtʲoʔ^{3}	CVʔ	3PL	ki^{3}-tʲoʔ^{1}	CVʔ

Class 4 is not found on roots with laryngealized vowels, i.e. CʔVʔ roots. Since the metathesis consists of an alternation CVʔ ~ CʔV, vacuous relocation of the final glottalization gesture to the preceding vowel would presumably produce an alternation between CʔVʔ and first-person CʔV. It would look as though the final glottal stop had been deleted. It is interesting that this logically conceivable paradigm type, shown in (19), is not attested in Amuzgo.

(19) Unattested paradigm type

1SG	CʔV	1PL.INCL	CʔV
		1PL.EXCL	CʔV
2SG	CʔVʔ	2PL	CʔVʔ
3SG	CʔVʔ	3PL	CʔVʔ

Class 5, shown in (20), consists of glottal-final roots and is similar to Class 1 in that there are no alternations within the paradigm in presence or location of the postvocalic glottal. As a consequence of the phonological constraint against glottal-final first-person forms, however, we see epenthesis of an echo vowel in both singular and plural first-person forms. The Class 5 paradigm appears to be the only option for CʔVʔ roots such as in (20b).

(20) Class 5: First-person vowel epenthesis

a. CVʔ 'mend', completive (Tapia García n.d.:605)

1SG	$thaʔ^{53}a^{3}$	CVʔV	1PL.INCL	$thaʔ^{35}a^{5}$	CVʔV
			1PL.EXCL	$thaʔ^{51}a^{3}$	CVʔV
2SG	$thaʔ^{51}$	CVʔ	2PL	$thaʔ^{35}$	CVʔ
3SG	$thaʔ^{35}$	CVʔ	3PL	$thaʔ^{35}$	CVʔ

b. CʔVʔ 'friend' (Tapia García n.d.:229)

1SG	$ʃʔiaʔ^{12}a^{3}$	CʔVʔV	1PL.INCL	$ʃʔiaʔ^{12}a^{5}$	CʔVʔV
			1PL.EXCL	$ʃʔiaʔ^{51}a^{3}$	CʔVʔV
2SG	$ʃʔiaʔ^{51}$	CʔVʔ	2PL	$ʃʔiaʔ^{12}$	CʔVʔ
3SG	$ʃʔiaʔ^{12}$	CʔVʔ	3PL	$ʃʔiaʔ^{12}$	CʔVʔ

To the extent that we want to unify Classes 4 and 5 with a common phonological requirement against glottal-final first person forms, the analysis is best formalized within the constraint-based machinery of Optimality Theory (Prince & Smolensky 1993). An argument in favor of the phonological-requirement analysis, considering the Class 4 pattern, is that vowel laryngealization via introduction of a [+constricted glottis] feature is not attested as an operation elsewhere in the glottalization paradigms. That is, no paradigm is attested where first-person forms are of the CʔV shape, while others are CV. Instead, first-person CʔV seems to require that a [+constricted glottis] feature already be present in the underlying form. Similarly, the addition of an echo vowel across all first-person forms (as in Class 5) is also not attested in the absence of final glottal stops in other persons; as such it can be seen as phonologically conditioned.

An OT analysis in terms of Optimality Theory requires two sets of constraint rankings to derive the preferred repair strategy for each class in the face of a high-ranked constraint against glottal-final first-person forms. Relevant constraints are listed in (21).

(21) Constraints

a. *ʔ#: Word-final glottalization is prohibited.

b. DEP: Output features must have a correspondent in the input. (Penalize epenthesis.)

c. LINEARITY: Preserve input precedence relations in the output. (Penalize metathesis.)
d. MAX: Input features must have a correspondent in the output. (Penalize deletion.)

The constraint in (21) must apply in the first person only, and not in other person categories. This could be achieved by specifying the morphological context within the constraint itself (an "indexed constraint" approach) and reformulating it as e.g. *ʔ#{first person}. Alternatively, first-person features could trigger a cophonology where the constraint *ʔ# becomes active, in comparison to its low ranking and irrelevance in the phonological grammars associated with other morphological constructions; see Inkelas & Zoll (2007). Here I limit myself to the observation that the *ʔ# constraint is highly ranked for first-person forms, without deciding between finer-grained analytical options.

Each glottal-final root must carry a lexical specification for one of the constraint rankings in (22), which determines the least costly and therefore preferred repair. These indexation diacritics can be considered to be the formal morphological representation of the inflectional classes for glottalization.

(22) Constraint rankings for glottalization classes
a. Metathesis (Class 4): MAX, DEP >> LINEARITY
It is worse to delete or epenthesize than it is to metathesize.
b. Epenthesis (Class 5): MAX, LINEARITY >> DEP
It is worse to delete or metathesize than it is to insert an epenthetic segment.

An example of how this analysis works is shown in the tableau in (23). The lexical entry of the verb 'begin', previously seen in (18a), contains the information '/taʔ/, [4]', where the arbitrarily labelled abstract diacritic triggers subgrammar (22a) to control the phonological selection of the correct allormoph.

(23) Analysis of glottalization metathesis: /taʔ/ ~ 'begin, [4]'

/taʔ/	*ʔ#	MAX	DEP	LINEARITY
a. taʔ	*!			
b. ta		*!		
→ c. tʔa				*
d. taʔa			*!	

Candidate (23a), the faithful form, is ruled out by the high-ranked phonological constraint against glottal-final forms. Because DEP and MAX are ranked more highly than LINEARITY in the subgrammar associated with this lexical item, the glottal-metathesis candidate wins. Different rankings of the three faithfulness constraints, in other subgrammars, would cause candidates with other repair types to emerge as the surface forms.

Both the Class 4 and Class 5 rankings include relatively higher ranking of a MAX constraint, which prevents the obvious repair of deletion from taking place. A nice result is that by ranking MAX above the other faithfulness constraints, we get the non-attestation of the paradigm in (19) for free: CʔVʔ roots cannot surface as CʔV in the first person (assuming that vowel laryngealization cannot simultaneously correspond to both of the input [+constricted glottis] specifications), since any CʔV candidate will violate MAX with respect to the CʔVʔ input. Instead, since the candidate violating LINEARITY in this case also violates MAX, the winner is actually the epenthesis candidate –indistinguishable from Class 5. That is, on this analysis CʔVʔ roots will inevitably surface in the same way, with echo-vowel epenthesis, under either the Class 4 or 5 constraint rankings.

(24) Class 4 constraint ranking results in epenthesis for CʔVʔ inputs

/tʔ$_1$aʔ$_2$/	*ʔ#	MAX	DEP	LINEARITY
a. tʔaʔ	*!			
b. taʔ		*!		
c. tʔ$_1$a		*!		
d. tʔ$_2$a		*!		*
→ e. tʔaʔa			*	

This convergence between Classes 4 and 5 brings us back to the topic of variation between the two classes, as first raised in (8) above. Buck (2000: 384) gives two examples of glottal-final roots that vary between metathesis and epenthesis. In (25), the first-person forms show only segments, since the source does not provide the tones, and the relevant stem is the final syllable, disregarding prefixes. As above, glottal-final first-person forms have been interpreted as containing echo vowels.

(25) Class 4~5 variation in plural stems (Buck 2000: 384)

	3PL	1PL
a.	ko^{3}-nãʔ^{1}-**tũãʔ**^{35} PL-CAUS-wrinkle	-tʔũã OR -tũãʔ(-ã)
b.	ko^{3}-thueʔ^{3}-**ɲdʲaʔ**^{53} PL-CAUS-separate	-ɲdʲʔa OR -ɲdʲaʔ(a)

Both cases of reported variation are in plural stems. Inspection of relevant entries in Stewart & Stewart (2000) confirms that in both cases, the singular stems show metathesis (the Class 4-like pattern) only. This means that for speakers who have the Class 5-like variant first-person forms in (25), the paradigms of these words would be a hybrid of the two first-person repairs. The existence of such hybrid paradigms reinforces the idea that Classes 4 and 5 differ minimally in how they derive first-person forms, and are similar otherwise.

(26) Mixed paradigm in (25)

	Sg	Pl
1	**CʔV**	**CVʔV**
2	CVʔ	CVʔ
3	CVʔ	CVʔ

This paradigm-internal variation cannot be verified in Tapia García (n.d.), who in fact lists the words in (25) as being standardly Class 5 across singular and plural. The full extent of variation between Stewart & Stewart (2000) and Tapia García (n.d.) in the inflectional classification of glottal-final roots remains to be investigated, as do any wider patterns of variation in the community.

To close this section, we can go beyond Classes 4 and 5 to observe that glottal-final first-person forms are not attested in any glottalization class at all. This was trivially true according to the analysis in §4, where first-person forms did not undergo any glottalization-related morphophonological operations in Classes 1-3. However, the idea that the constraint *ʔ#{first person} holds more generally in Amuzgo morphology raises the question of whether the 2SG/3SG inflectional glottal stop really is limited to those two cells, or whether it is also added to all singular forms at a deeper level of abstraction, but simply prevented from surfacing in 1SG forms by *ʔ#{first person}. The participation of Classes 2 and 3 in the vowel-final conspiracy could thus either be phonologically driven, which simplifies the morphological description of the environments for the inflectional glottal stop by expanding them to singular forms in general; or we could continue to analyze it as an accidental morphological fact. More research may yield evidence one way or the other.

6. Discussion

The parameter hierarchy capturing the morphophonological distinctions between the Amuzgo glottalization classes is summarized again in (27), repeated from (7).

(27)a. V-final
Cl. 1 Inflectional glottal
Cl. 2 Dissimilation
Cl. 3

b. ʔ-final
ʔ-Metathesis V-Epenthesis
Cl. 4 Cl. 5

The approach follows Trommer (2008) and Alexiadou & Müller (2008), in that it is possible to capture natural classes of inflectional classes by breaking them down into component features and investigating the relationships of those features to each other, for example hierarchical dependency versus full recombinability.

A slightly different way of conceptualizing the glottalization-class parameters, which focuses on the morphophonology rather than taking underlying root phonotactics as a starting point, is in (28) and (29).

(28) Alternative hierarchy
[-inflectional glottal] [+inflectional glottal]
Classes 1, 4, 5 / \
[-dissim.] [+dissim.]
Class 2 Class 3

The feature that does the most work in the present analysis is [+inflectional glottal], which inserts a final glottal stop in singular forms, separating Classes 2 and 3 from the other classes. Phonotactic asymmetries between singular and plural paradigms are entirely due to the presence of these inflectional glottal stops on singular forms only. The assignment of a lexical item to Class 2 or 3 does not appear to be predictable, and so we must consider them as morphologically distinct inflectional classes; yet they still share a featural diacritic that triggers concatenation of the same morphological material. The characteristic separating those two classes is the retention versus deletion of vowel laryngealization in the presence of the final glottal. This option, which we might call [±dissimilation], can be seen as a dependent feature of [+inflectional glottal] since it is not an available option elsewhere.

Meanwhile, the feature separating Class 4 from Classes 1 and 5 is the Metathesis phonological subgrammar in (22a); we can label this as [±metathesis]. The diagram in (29) puts Classes 1 and 5 under a common node, sharing the features [-inflectional glottal] and [-metathesis], meaning that they show no stem-shape alternations apart from the first-person epenthetic vowel in the case of glottal-final stems. Because assignment to Class 1 or 5 is phonologically predictable based on whether the underlying root is vowel-final or glottal-final, no further morphological specification is needed.

(29) More features for inflectional classes

[-inflectional glottal]		[+inflectional glottal]	
/	\	/	\
[-metathesis]	[+metathesis]	[-dissimil.]	[+dissimil.]
Classes 1, 5	Class 4	Class 2	Class 3

One prediction of the hierarchical approach in (27-29) is that paradigms of the sort in (30), which combine the structurally incompatible features [+inflectional glottal] and [+metathesis], should be impossible.

(30) Impossible paradigm? CV root; [+inflectional glottal], [+metathesis]

1SG	CʔV	1PL.INCL	CV
		1PL.EXCL	CV
2SG	CVʔ	2PL	CV
3SG	CVʔ	3PL	CV

The paradigm in (30) contains an inflectional glottal stop in all singular forms, following the hypothesis at the end of §5, which has undergone metathesis in the 1SG form. If such paradigms are attested, they would constitute evidence that the glottalization-class features are not hierarchically organized. Thus far I am aware of only one paradigm of the shape in (30), which is given in (31).

(31) 'plant', incompletive (Buck 2000: 416)

1SG	ma^{3}-nʔɔ̃^{53}	CʔV	1PL.INCL	ko^{3}-nɔ̃^{12}-ɔ̃	CV
			1PL.EXCL	ko^{3}-nɔ̃^{51}	CV
2SG	ma^{3}-nõʔ^{51}	CVʔ	2PL	ko^{3}-nõ^{1}	CV
3SG	ʔ^{5}-nõʔ^{3}	CVʔ	3PL	ko^{3}-nõ^{1}	CV

Segmentally, the singular and plural forms do not show diagnostics of suppletion. More generally, the set of irregular verbs may provide further clues as to what patterns should or should not be considered to be within the glottalization-class system. For example, SIL glottalization class B is described by Buck (2000: 378) as creating exceptional second-person stems according to the pattern in (32).

(32) SIL glottalization class B

	Shape	a. 'make' (completive)	b. 'liver, soul'
1SG	CʔV	sʔa^{53}	tsʔɔ̃^{53}
2SG	CVʔ	saʔ^{53}	tsõʔ^{51}
3SG	CʔV	sʔa^{35}	tsʔõ^{3}

However, inspection of the entire Stewart & Stewart (2000) dictionary turns up only one other lexical item that is categorized as Class B, *jʔõ*^{35} 'carry'. In Tapia García (n.d.) this word does not show any stem alternation, in what appears to be a genuine case of inter-speaker variation, leaving speakers like Tapia García with only two candidates (the ones in 32) for the Class B category. The tonal alternations in (32a-b) further suggest that the 2SG stem of (32a) is actually vowel-final, in light of the Tonal Lowering rule in (6), while the 2SG stem of (32b) follows the tonal pattern of ʔ-final stems, meaning that this two-member class of stem alternations should be split into two patterns with one member each. No reliable data are currently available to me on the stem shapes of irregular *jʔõ*^{35} 'carry' for speakers who conjugate this verb irregularly. Thus the forms in (32) should probably not be taken to define additional glottalization classes in the absence of further reinforcement.

At this stage, the principal value of the proposed analysis is as an impetus to test whether any other morphological process appears to refer to the posited features, for example by treating Classes 2 and 3 as a natural class. The fact that terminal nodes are indexed to different phonological subgrammars opens the possibility that these could interact with other morphologically specific phonological requirements besides the *ʔ#

constraint in the first person. Additionally, the combination of hierarchical structure with marked and unmarked feature values suggests the possibility of glottalization-class alternations: for example a hypothetical process of derivational morphology that reduces markedness by merging Class 4 to Class 5 in derived forms, and/or merges Class 3 into Class 2. Lastly, there is the negative prediction that Classes 2 and 4 should never form a natural class or alternate with each other, despite the identical stem shapes in their singular paradigms.

Already, though, the current proposal can be argued to represent progress over the analysis of Buck (2000) and Stewart & Stewart (2000). Table 11 is adapted from Buck (2000: 379).

Class	Root	1st person	2nd person
A	V-final	---	addition of final ʔ
B	V-final	---	addition of final ʔ; suppression of vowel laryngealization
C	ʔ-final	movement of final ʔ (metathesis)	retention of final ʔ
D	ʔ-final	retention of final ʔ	retention of final ʔ
E	ʔ-final	loss (deletion) of final ʔ	retention of final ʔ

Table 11. Previous analysis: SIL materials

The salient similarities are in the division between V-final and ʔ-final classes, and in the defining of morphophonological operations that characterize each class. Two major differences are that the SIL class designations assume that third-person stems reflect underlying roots, and that singular and plural roots are classified separately.

The assumption that third-person stems reflect underlying roots lead to opposite analyses of Class 2 in this paper and the corresponding Class E in the schema in Table 11. In this paper, we have analyzed Class 2 as adding the inflectional glottal stop in the 2SG and 3SG, while Buck (2000) analyzes the pattern as first-person deletion of an underlying glottal stop.

The relative advantages of the present analysis becomes apparent when full paradigms are taken into account. Buck (2000: 380) states that glottalization classes alternate, or fail to alternate, in systematic ways between singular and plural paradigms of the same lexical item. For example, Class E is stipulated to be possible only in singular forms, and all Class E singulars convert into Class A for their plural forms. The reader can verify that this description corresponds to Class 2. Similarly, the singular paradigms of our Classes 3 and 4 were conflated under Class C, where both show metathesis. Buck (2000: 380) then notes that metathesis (Class C) in singular paradigms must correspond either to metathesis in the plural (i.e. our Class 4) or to Class A (i.e. our Class 3). Here, the additional fact that Class 3 plural stems always have laryngealized vowels –in other words, the systematic absence of the paradigm in (30)– goes unexplained. In contrast, we analyzed Classes 3 and 4 as having different underlying forms and undergoing different morphological operations, which produce a surface similarity in singular forms that is only coincidental. In general, the large number of arbitrary restrictions suggests that it is not accurate to analyze singulars and plurals separately, nor is there a morphologically productive process of mapping glottalization classes from one to the other. Further generalizations enabled by the current analysis, for example the tonal allophony facts in (5), variation between Classes 4 and 5, and the independent motivation for 2SG/3SG inflectional glottals provided by nominal possessive paradigms, additionally support an analysis of Amuzgo glottalization classes that is more along the lines of what has been proposed here.

In sum, this paper has argued that Amuzgo glottalization classes are lexically specified in terms of abstract features that can trigger different kinds of instructions: to provide phonological material, in the form of inflectional glottal stops; or to select a phonological subgrammar. The feature hierarchy captures the internal structure of the glottalization classes, which, far from being morphologically monolithic, break down into a limited set of morphophonological parameters. The combination of these parameters, and their joint interaction with an additional phonological constraint on first person forms, gives rise to a restricted range of possible allomorph constellations (in terms of the phonotactics of glottalization gestures) in inflectional paradigms. In particular, the distinction between lexical and inflectional final glottal stops enabled a coherent analysis of some attested restrictions, and clarified the relationship of the glottalization classes to each other as well as to the phonological shapes of underlying roots.

The phenomena described include complex interactions of morphological and phonological factors, in that the morphosyntactic feature marking first person introduces a phonological constraint, while additional constraints (and sometimes phonological material) were supplied as a result of glottalization-class specifications. Further research will show the extent to which such omnidirectional visibility of morphosyntactic features, phonological information, and inflection-class diacritics is a structural feature of Amuzgo, and perhaps Oto-Manguean languages more generally.

Acknowledgments

This paper would not be possible without the insight, brilliance, and dedication of Fermín Tapia García, who has worked extensively to document and to share knowledge about his language. Foremost thanks go to him, Oralia Tapia Cruz, their families, and everyone else in San Pedro Amuzgos who has been supportive of my studies. Fieldwork was funded by a Research Support Fund grant from the School of Languages, Linguistics, and Cultures at the University of Manchester. Comments from the editors of this special issue of *Amerindia*, and the audience at the Surrey Workshop on Inflectional Morphology and Verb Classes in Oto-Manguean, have been of great help in improving the analysis. I take full responsibility for any remaining errors.

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