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Consonant-Tone-Phonation Interactions in Guienagati Zapotec

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Abstract

Guienagati Zapotec is one of three modern languages that comprise the Northeast Tehuantepec Zapotec (NETZ) subfamily. Like most Zapotec languages, Guienagati has a complex suprasegmental system involving contrastive tones and phonation types that both serve lexical and grammatical functions. There are also three types of codas: voiceless singleton, voiced singleton, and geminate. The distribution of coda type with respect to suprasegmental category of the preceding vowel is highly restricted. This study addresses the observation that geminate codas and voiceless singleton codas occur in complementary environments, despite evidence suggesting that the two consonant types are not allophonic. By comparing the three modern NETZ languages, the suprasegmental categories of Proto-NETZ are determined to have included breathiness in three environments: preceding geminate codas, and accompanying high tone or rearticulated phonation. In Guienagati, breathiness before geminate consonants was lost due to tonogenesis. Breathiness accompanying high tone and rearticulated phonation was lost due to the shift of [+spread glottis] rightward onto the coda, yielding the voiceless singleton series of consonants. This dual path to loss of breathiness helps to explain why voiceless singletons codas do not occur in the same environments as geminate codas.

Index Terms: Zapotec, tone, phonation, historical, tonogenesis

1 Introduction

Guienagati Zapotec is spoken in the municipality of Santa María Guienagati, Oaxaca, Mexico. Smith Stark [1] includes Guienagati Zapotec in the Transyautepecan subgroup of Central Zapotec languages. There is evidence that the Transyautepecan subgroup does not constitute a cohesive set of closely related languages, but it is clear that three of the languages–Guienagati, Guevea, and Petapa–are very closely related and comprise their own subgroup called Northeast Tehuantepec Zapotec (NETZ) [2]. As in most Zapotec languages, Guienagati has a complex suprasegmental system, with pitch and phonation each contributing both lexical and grammatical information. Unlike most Zapotec languages, however, Guienagati has a very large number of consonant phonemes in its inventory. A brief description of the phonological inventory is given in §2, and §3 includes some observations about the language's phonotactics. In §4 cognate forms from the other NETZ languages, Guevea and Petapa, are compared to forms from Guienagati. The results of this comparison indicate that there is contrastive breathiness on vowels in Guevea and Petapa that is absent in Guienagati. In §5 a reconstruction is proposed for the suprasegmental system of Proto-NETZ, along with diachronic explanations for how the current state of Guienagati evolved from Proto-NETZ. Finally, §6 includes concluding remarks and a discussion of interactions between tones, phonation, and consonant voicing in Guienagati Zapotec.

2 Phonology

Historically, roots in Zapotec had either the structure (C)V or (C1)V1C2V2. Guienagati has (C)V roots, but in the historically disyllabic roots, the V2 has been lost, rendering (C1)V1C2 roots. This can been seen when comparing cognate forms from Guienagati and Petapa, which retains the V2.

Table 1. *Root structure in Guienagati compared to Petapa.*

	Guienagati	**Petapa**
(a) 'wood'	yák	yá^{h}kta
(b) 'head'	ìk$^{:j}$	gìhki
(c) 'eats'	r-ák^{w}	r-á^{h}ku

As seen in Table 1b, where the V2 in Petapa is a non-low front vowel, the C2 in Guienagati is palatalized. Where the V2 in Petapa is a high back rounded vowel, a velar C2 in Guienagati is labialized (1c). Each root also carries contrastive tone and phonation, as do pronominal enclitics. Prefixes in Guienagati Zapotec, such as those used to indicate verbal TAM and nominal possession, do not carry contrastive tone or phonation. The remainder of this section is dedicated to the description of the segments and suprasegmental components of Guienagati Zapotec sound system.

2.1. Consonants

Guienagati Zapotec has about 60 consonants, which is a large number not only for a Zapotec language, but for any language [3]. There are four main places of articulation: bilabial, dental, post-alveolar, and velar. The elevated number of consonants is due in part to the existence of a palatalized series at the bilabial, dental, and velar places of articulation, and a labialized series at the velar place of articulation. Another contributing factor to the high number of consonants is the existence of a three-way voicing/duration contrast among coda consonants. While onset consonants can be either voiced or voiceless, coda consonants can be geminate, voiceless singleton, or voiced singleton.

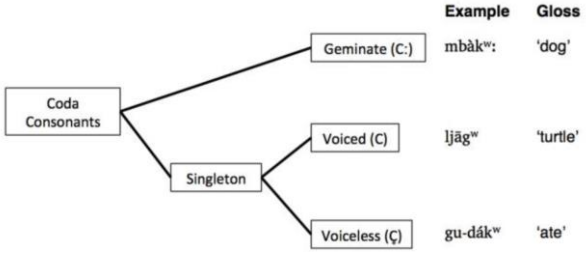

Figure 1. *Coda consonant contrasts in Guienagati Zapotec.*

Figure 1 illustrates the three-way contrast among coda consonants. Geminate consonants (hereby represented with C:) can be identified by their long duration. Geminate sonorants are

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always voiced, while geminate obstruents are voiceless, and often exhibit a short period of preaspiration when occurring after a low tone. Another identifying feature of geminate consonants is that they cause the preceding vowel to be significantly shorter than a vowel in an open syllable or a vowel that precedes a singleton consonant.

Singleton consonants are relatively short in duration, and preceding vowels are phonetically long. Voiced singletons (C) (especially obstruents) are often devoiced when they occur before a pause, but are voiced in other environments. Voiceless singletons (Ç) are never voiced, and obstruents exhibit preaspiration similar to geminate obstruents. Voiceless laterals are realized as voiceless lateral fricatives. Voiceless nasals are actually often voiced, but accompanied by nasal aspiration.

2.2. Vowels and suprasegmental categories

There are five vowel qualities (*a, e, i, o, u*) in Guienagati Zapotec, each of which can occur with any of the various laryngeal modifications in the language. Vowels can be divided into two main groups: modal and glottalized. There is a contrast between low (L), mid (M), and high (H) tone among modal vowels. The L tone begins at the mid level and falls to a low target at the end of the vowel. The M tone is flat, but has a rising allophone when the following morpheme has a H tone. The H tone reaches its high target very early and remains high throughout its production.

Glottalized vowels, on the other hand, do not carry contrastive tone. Instead, there is a contrast between checked vowels, which are realized with a falling pitch and terminate in a glottal stop, and rearticulated vowels, which are realized as two periods of modal phonation separated by a glottal stop or a brief period of creakiness. The pitch on rearticulated vowels is typically in the mid range, and rises when preceding a morpheme with a H tone. The contrastive nature of the suprasegmental categories is illustrated in Figure 2.

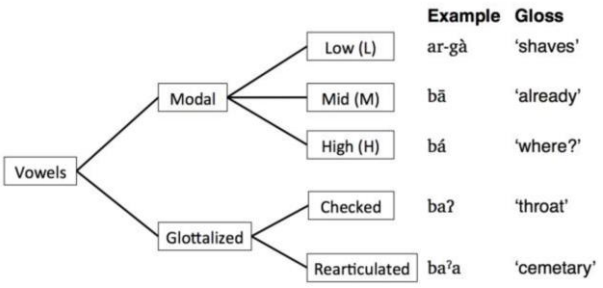

Figure 2. *Suprasegmental contrasts in Guienagati Zapotec.*

3 Phonotactics

While there is a three-way duration/voicing contrast among coda consonants, their distribution with respect to the suprasegmental category of the preceding vowel is highly restricted. As shown in Table 2, the consonantal contrast that occurs following modal vowels with L or M tone is voiced singleton vs. geminate. Following modal H tone there is neutralization, and only voiceless singletons can occur as codas. The contrast following both checked and rearticulated vowels is voiced vs. voiceless singleton. It is difficult to determine synchronically whether the suprasegmental category conditions the following coda consonants, or whether the coda consonant conditions which suprasegmental category can occur on the preceding vowel. As such, it makes sense to think of this relationship as a system of rime types.

Table 2. *Distribution of coda consonants with respect to preceding suprasegemental (SS) category.*

Phonation	SS Category	Possible Codas
Modal	Low	C vs. C:
	Mid	C vs. C:
	High	Ç
Glottalized	Checked	C vs. Ç
	Rearticulated	C vs. Ç

Upon initial examination of this distribution, one notices that C: and Ç are in complementary distribution. That is to say, no single suprasegmental category can be followed by both C: and Ç. This observation might lead one to conclude that C: and Ç are allophones, and positing such would significantly reduce the seemingly inflated number of consonants in the language's inventory. However, such an analysis is difficult because it is hard to identify the conditioning environment for any of the coda consonants. C can occur following any suprasegmental category except for H tone. C: can occur only after modal vowels, but not after modal vowels with H tone. Ç occurs after glottalized vowels and after modal vowels with H tone. It is difficult to make any generalization about which type of consonant can occur after modal vs. glottalized vowels. There is neutralization following H tone, and in such a case it seems unusual that the only possible coda is Ç , since it does not occur after the other two modal tones. A synchronic explanation for Ç following H tones could be that it serves as a redundant cue to contrast rimes with M tone and C codas.

There is another reason why C: and Ç are likely not allophones. Both types of consonants contrast with C, but the function that the C vs. C: contrast serves is different from the function of the C vs. Ç contrast. The C vs. C: contrast serves to distinguish lexical items from each other. (3a-b), shows a minimal pair illustrating the contrastive nature of voiced singleton *g* vs. geminate *k:*. The difference between the two sounds changes the root meaning from 'get stuck' to 'become.' The C vs. Ç contrast, on the other hand, serves a primarily grammatical function. As seen in (3c-d), the voiced *n* is used in the form of 'dig' inflected for the Potential aspect, and the voiceless *n̥* is used in the Habitual form.

(3) (a) z-àg=mé 's/he will get sick'
FUT-'get.stuck=3sh
(b) z-àk:=mé 's/he will become'
FUT-become=3sh
(c) kaʔaŋ=mé 's/he should dig'
POT.dig=3sh
(d) ar-gaʔaŋ̥=mé 's/he digs'
HAB-dig=3sh

While the distribution of C, C:, and Ç is easy enough to describe, it still seems a bit curious that C: and Ç are in complementary distribution, despite not being allophones. In the following sections, a possible historical explanation for this distribution is proposed.

4 Breathiness in NETZ

Comparing forms from Guienagati with cognate forms from Guevea and Petapa offers some insight into how the synchronic distribution of coda consonants came to be. Table 4 is arranged according the rime type. The first two rows have geminate

codas, while the remaining rows are grouped according to suprasegmental category and presence of a coda.

Table 4. *Cognate forms from the NETZ languages.*

Rime type	Guie-nagati	Guevea	Petapa	Gloss
V̀C:	gùtj:	**gū^{h}t^{j}:**	**gù^{h}ti**	'died'
VC:	gātj:	g-āt^{j}:	g-ăti	'should die'
V̀C	ar-bàn	r-bān	ra-bàna	'steals'
V̀	dò	dō	dò	'sprig'
VC	ar-ʒāl	r-ʒăl	ra-ʒăla	'(it) opens'
V̄	mbi-syē	mp-syĕ	mbe-syă	'hawk'
V́Ç̥	dáŋ̥	**dâ^{h}aŋ**	**dá^{h}ani**	'mountain'
V́	ar-bé	r-bê	**ra-bé^{h}**	'chooses'
V^{ʔ}VC	mbe^{ʔ}edz^{j}	mbĕ^{ʔ}edz^{j}	mbēʔedzi	'tiger'
V^{ʔ}VÇ̥	p-ʃa^{ʔ}al̥	**p-ʃă^{ʔ}a^{h}al**	**be-ʃā^{ʔ}a^{h}l̥a**	'sent'
V^{ʔ}V	gu-lo^{ʔ}o	gu-lŏ^{ʔ}o	**gu-lō^{ʔ}o^{h}**	'took out'
V^{ʔ}V	r-a^{ʔ}a	r-ă^{ʔ}a	r-ā^{ʔ}a	'lies down'
VʔC	ar-niʔbj	r-nî^{ʔ}ip^{j}	ra-nîʔpi	'moves'
VʔÇ̥	z-uʔt	zû^{ʔ}ut	z-ûʔtu	'will grind'
Vʔ	ar-dzeʔ	r-dzê^{ʔ}e	ra-dzêʔe	'(it) fills up'

While there are various systematic differences between the three languages, one that stands out is the fact that Guevea and Petapa have contrastive breathiness, but Guienagati does not. There are three rime types (indicated with blue print) in which Guevea has breathiness, and five in which Petapa has breathiness. In Guienagati, roots with C: codas can only have L or M tone on the nucleus. Guienagati rime type V̀C: corresponds to roots with breathiness in both Guevea and Petapa, as in 'died.' Guienagati H tone corresponds to a high breathy tone in Petapa, regardless of whether or not there is a C2. Rearticulated vowels with no coda in Guienagati sometimes correspond to rearticulated vowels in Petapa ('lies down'), and sometimes to breathy rearticulated vowels ('took out'). Guienagati rime type VʔVÇ̥ corresponds to breathy rearticulated vowels in Petapa, and breathy rising toned vowels in in Guevea.

5 Reconstruction and changes

In Guevea and Petapa, breathiness can occur where in Guienagati there are geminate codas, where there are H tones, and where there are rearticulated vowels. In this section, evidence is presented to support the hypothesis that the presence of breathiness is conservative within the NETZ subgroup. In addition, sound changes are posited to explain how Guienagati arrived at its current state, lacking breathiness.

Based on the correspondence patterns summarized in Table 4, a reconstruction of the suprasegmental system of Proto-NETZ is proposed in Figure 3. Note that this figure only accounts for rimes with singleton codas or no coda. Rimes with geminate codas are discussed in §5.1.

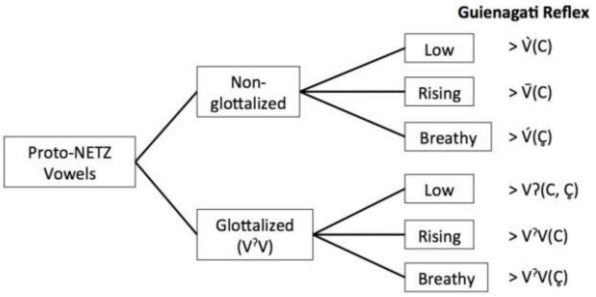

Figure 3. *Proposed reconstruction for the suprasegmental system of Proto-NETZ.*

5.1. *CVhC: > CV̀ hC: > CV̀ C:

Both Guevea and Petapa have breathiness that can occur before geminate consonants. As seen in the words for 'died' and 'should die' in Table 4, the contrast between breathy and modal vowels in this position serves a grammatical function. The Completive form ('died') has a breathy vowel, while the Potential form ('should die') has a modal vowel. This distribution is the same in other Central Zapotec languages, such as Mitla [4] and Quiaviní [5] Zapotec. Table 4 shows the cognate forms of 'died' and 'should die' in those two languages.

Table 5. *Completive and Potential forms of the verb 'die' in Mitla and Quiaviní Zapotec.*

	Mitla	Quiaviní
'died'	gùht	gù^{h}t^{j}
'should die'	g-ĕt	g-ăt^{j}

The fact that four Central Zapotec languages–Guevea, Petapa, Mitla, and Quiaviní–have breathiness where Guienagati has a modal L tone is evidence that having breathiness before geminate consonants is a conservative trait. In Guienagati, traces of breathiness remain in the form of the preaspiration associated with geminate obstruents. As noted by Hombert [6], a post-vocalic *h* consonant can lead to the historical development of a falling tone. In these languages there is no consonantal *h*, but breathiness is realized as aspiration on the final portion of the vowel, yielding the same effect.

5.2. *CV́ h(C) > CV́ h(Ç̥) > CV́ (Ç̥)

Guienagati rimes that include a H tone correspond to roots with breathy vowels in Petapa, whether or not there is a C2. In Guevea, there is a corresponding breathy vowel only in cases where there is a C2. In Proto-NETZ, the high tone was accompanied by breathiness, serving as a redundant cue to distinguish it from the other non-glottalized tones. In Guevea, the breathiness was retained in CVC roots, but was lost in CV roots. In Petapa, breathiness was retained in both types of roots with a high tone. In Guienagati, the breathiness was lost completely in CV roots, as in Guevea. But in CVC roots, the breathiness shifted to the coda, where the now voiceless coda serves as a redundant cue to distinguish vowels with H from vowels with L or M.

5.3. *CVʔVh(C) > CVʔVh(Ç̥) > CVʔV(Ç̥)

Proto-NETZ also had a three-way suprasegmental contrast among glottalized vowels. The glottalization was realized as rearticulation in all three categories, and the contrast was between low, rising, and breathy rearticulated vowels (see

Figure 3). It may seem less than ideal to posit vowels that are both rearticulated, which involves glottal constriction, and breathy, which involves glottal spreading. However, the presence of such vowels in modern Petapa Zapotec, in both CV and CVCV roots, makes such a reconstruction seem plausible. In Guevea, the glottalization was retained, and breathiness was lost in CV roots. In CVC syllables the breathiness was retained, and the glottalization was lost. In Guienagati, the glottalization was retained, and the breathiness shifted to the coda, yielding voiceless singleton consonants.

6 Discussion

The current study finds that contrastive breathiness was lost in Guienagati Zapotec via two different mechanisms: tonogenesis and rightward shift of [+spread glottis]. So why did two different processes have to occur in the elimination of breathiness in Guienagati? Perhaps a hint can be found in the environments in which each process occurred. The rightward shift of [+spread glottis] to the C2 only occurred before singleton consonants, which were historically voiced. In this manner, the contrast was preserved and simply shifted from the vowel to the consonant. If tonogenesis were to have occurred in these situations, whereby the breathy vowel would have evolved into a L tone, then a contrast would be lost as a result of merging with the original V̀C rimes.

On the other hand, breathiness before geminate consonants may not have been able to shift to the right, since the majority of geminate consonants, being obstruents, are already voiceless. Instead, the contrast remained on the vowel, but in the form of a pitch contrast.

While it is difficult to say why speakers of Guienagati Zapotec eliminated breathiness from the sound system, it is possible to speculate on how the environment in which breathiness occurred influenced the manner in which it was eliminated. The dual paths to the loss of breathiness in Guienagati Zapotec provides an explanation for the synchronic complementary distribution of C̤: and C̥ . Breathiness was able to shift rightward to the coda consonant only if that consonant was originally voiced.

There have been many documented cases of diachronic interactions between tones and phonation. The most common story involving such interactions is tonogenesis, in which a consonant contrast is neutralized in favor of a once-redundant pitch contrast in an adjacent vowel, as proposed for Chinese [7] and Vietnamese [8]. Less attested are cases in which a pitch contrast is neutralized in favor of a phonation contrast. One such case is reported within Central Zapotec, for the Quiaviní variety [9]. This study has described a classic case of tonogenesis in Guienagati Zapotec, as well as a case of a suprasegmental phonation contrast evolving into a consonantal voicing contrast. This latter change seems to be quite rare, and possibly unattested in the literature of diachronic sound change.

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