Christian DiCanio*

# The evolution of tonally conditioned allomorphy in Triqui: evidence from spontaneous speech corpora

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**Abstract:** One of the defining characteristics of tonal systems in phonological theory is the notion of tonal stability (Goldsmith, John. 1990. *Autosegmental and metrical phonology*. Oxford: Blackwell; Yip, Moira. 2002. *Tone*. Cambridge: Cambridge University Press). Tones remain stable even if their tone-bearing unit changes or is deleted. In the context of historical sound change, tones may either persist as floating tones (from an autosegmental-metrical perspective) or fuse with adjacent syllables and give rise to more complex tonal inventories. However, the process of segmental loss which ultimately conditions historical tonal change is gradual in nature. Tone-bearing units may lenite or they may be optionally realized, leading listeners to rely on coarticulatory cues or phonetic information on adjacent syllables. In the current paper, I examine how variation in the realization of clitic pronouns is conditioned by adjacent tonal cues in Itunyoso Triqui (Otomanguean) within a corpus of spontaneous speech recordings. This research examines and provides evidence for the hypothesis that tonally conditioned allomorphy arises specifically when two conditions are met: (a) there is a morphological context where prosodic units are likely to lenite (highly redundant contexts); and (b) adjacent tonal cues are most informative at this morphophonological boundary. The findings shed light not only on how phonologically conditioned allomorphy arises but also on how variable deletion is sensitive to patterns of multiple exponence during language use.

**Keywords:** morphophonology; Otomanguean; speech corpora; tone; variation

## 1 Introduction

Processes of segmental deletion in sound change necessarily occur in stages. In a classical scenario, a stop may be produced with voicing in intervocalic position, then with approximantization at a later stage, and finally deleted at an even later stage, that is (1) */k/ > [g]/V_V; (2) */g/ > [ɣ̞]/V_V; (3) */ɣ/ > Ø. Patterns whereby lenition leads to loss are more common in prosodically weak positions within words (Barnes 2006; Bouavichith and Davidson 2013; Lavoie 2001; Parrell and Narayanan 2018) and in contexts where neutralization or loss does not lead to a loss in contrast (Gurevich 2004, 2011; Wedel et al. 2013). These types of contexts are equally responsible for patterns of reduction and lenition affecting morphophonological processes in human language – they are not solely responsible for phonological and phonetic change.

One relevant context of morphophonological change occurs with patterns of multiple exponence, where "multiple realizations of a single morphosemantic feature, bundle of features, or derivational category *surface* within a word" (Harris 2017, 9) (emphasis in original). If one of those features happens to occur in a prosodically weak position, then it may be more prone to loss while the remaining feature carries the functional load of the morpheme in question. This is akin to processes of gradual cue reweighting in the acoustic signal which may lead to patterns of cue loss in phonological change (Beddor 2009; Coetzee et al. 2018; Kirby 2018; Ohala 1989). The process whereby morphophonological features are reanalyzed (or reweighted) is difficult to observe within endangered or under-described languages where there may be (a) little historical linguistic research,

***Corresponding author: Christian DiCanio,** Department of Linguistics, University at Buffalo, Buffalo, NY, USA,
E-mail: cdicanio@buffalo.edu

and/or (b) no existing record of past stages of the language. In this paper, I examine a pattern of ongoing morphophonological change in Itunyoso Triqui, a Mixtecan (Otomanguean) language spoken in southern Mexico. The second person singular pronominal clitic, /=ɾeʔ$^1$/, may be variably reduced to =[ɾ] or deleted.[1] Importantly, this clitic conditions unique tonal changes on certain stem types – the pattern involves multiple exponence for certain roots. I examine a corpus of 104 Triqui texts (9 h of spontaneous speech) and examine the productions of this clitic in terms of degree of reduction and preceding stem type. I find that patterns of reduction are statistically more frequent in contexts where the tonal exponent of the clitic (on the preceding stem) is highly predictable. The findings suggest a pathway for the evolution of phonologically conditioned tonal allomorphy (cf. Paster 2009) grounded in general processes of prosodic weakening and functional load.

## 1.1 Background: morphological exponence and deletion in sound change

Morphological functional load may create resistance to otherwise regular patterns of deletion in sound change. One of the most widely discussed examples of this is found in English coronal stop deletion, for example, kep(t), mis(t). Final coronal stops are variably deleted in many dialects of English, but they are more likely to be retained in contexts where they are the sole exponent of past tense morphology (Guy 1991; Thomas 2007; Wolfram and Thomas 2002). Deletion is more common in monomorphemic words (*mist, pact*) than in strong verbs where the stop marks past tense (*slept, wept*), which itself is more common than deletion in weak verbs where it is the sole marker of the past tense (*missed, packed*) (Guy, 1991). In Ancient Greek, intervocalic /s/ is lost via regular patterns of sound change, but not in contexts where it is the aorist suffix (Morpurgo Davies 2012). In Middle High German, final schwa was lost in a number of disparate phonological contexts, but remained stable after voiced obstruents (Raffelsiefen 2000). Importantly, it was exceptionally retained in contexts where it served a morphological role, that is, in verbal affixation or as a morphological exponent of neuter plural nouns.

In certain Mixtec languages, we observe a similar process where tonal allomorphy has evolved precisely in contexts where deletion would otherwise lead to the loss of morphological contrast. In Yoloxóchitl Mixtec (ISO [xty]), the 1s clitic is marked as a lower register tone (/2/) which attaches to the right edge of the root, for example, /ni$^1$i$^4$/ 'blood' > /ni$^1$i$^{42}$/ 'my blood'; /kã$^1$ã$^3$/ 'to get used to' > /kã$^1$ã$^{32}$/ 'I get used to' (Castillo García 2007; Palancar et al. 2016).[2] However, in roots ending with a low tone (level /2/ or /1/), the allomorph of the 1s clitic is /=ju$^1$/, for example, /ʃa$^1$a$^1$=ju$^1$/ 'arrive=1s'; /ka$^3$ni$^2$=ju$^1$/ 'spoil/ruin=1s.' The origin of the low tone as a reflex of the 1s pronoun in these Mixtec varieties is the clitic /=ju$^1$/, suggesting that, at one point, this clitic conditioned low tone spreading onto the preceding vowel and a subsequent process of segmental deletion of the =[ju] syllable.[3] The result of this patterning is the maintenance of morphological function: where deletion would have resulted in morphological contrast neutralization, it failed to apply.[4]

Two explanations have been offered to explain morphological resistance to deletion. The first explanation states that deletion is particularly sensitive to the functional load of the targeted contrast. Speakers are less likely to delete or neutralize contrasts in contexts where such a change would lead to a substantial increase in homophony (lexical or morphological) and correspondingly more likely to delete segments in contexts where root-conditioned phonology maintains morphological contrast (Blevins and Wedel 2009; Wedel 2012; Wedel

**1** Tones are marked with superscript numerals in this paper, following modern transcriptional practice in work on many Otomanguean languages. In this practice, /1/ is low and /5/ is high.

**2** Tones are aligned with moras in Yoloxóchitl Mixtec and many other Mixtec varieties (see McKendry 2013) and so tonal transcription follows each mora (DiCanio et al. 2014). Examples are glossed following the Leipzig Glossing Rules. Abbreviations used: 1 first person; 2 second person; 3 third person; s singular; p plural; du dual; incl inclusive; excl exclusive; m masculine; f feminine; anim animate; top topical; caus causative; iter iterative; pot potential; perf perfective; q question (particle).

**3** Language internal evidence favors this analysis as many of the pronominal clitics replace the vowel and tone of the final syllable (Castillo García 2007).

**4** Another analysis of this alternation argues that the low tone allomorph and the /=ju$^1$/ allomorph have distinct origins, the latter reserved as a marker of respect towards the addressee in Yucunany (San Juan Mixtepec) Mixtec (Paster 2006). Even in this Mixtec variety, low-toned roots never take the low tone allomorph of the 1s pronoun – all take the /=ju$^1$/ allomorph.

et al. 2013). In fact, morphological resistance to deletion is one established source of *inhibited sound change* (Blevins and Wedel 2009). A second explanation is that contexts where deletion is more likely are specifically those cases where the morphological boundary is rendered ambiguous, that is, the root-affix boundary in *kep-t* is not identical to that of *dream-ed* (Guy 1991). Greater rates of /t/-deletion in the former example arise because speakers treat such stems as morphological blends. In the current paper, I examine an ongoing process of allomorph reduction in Itunyoso Triqui which resembles the Mixtec pattern above. I consider each of these explanations after analyzing spontaneous speech corpus data.

# 2 Background: Itunyoso Triqui

## 2.1 Language background

Itunyoso Triqui [itunˈjoʊsoʊ ˈtriki] (Spanish [ˈtriki ðe itunˈjoso]) is an Otomanguean language (Mixtecan family) spoken by approximately 2,500 people in the towns of San Martín Itunyoso and La Concepción Itunyoso in Oaxaca, Mexico; and in expatriate communities in Mexico and the United States (ISO [trq]). It is one of three major dialects/variants of Triqui, the others being Chicahuaxtla Triqui (ISO [trs]) and Copala Triqui (ISO [trc]) (Hernández Mendoza 2017; Hollenbach 1984, 2004; Longacre 1952). These dialects have limited mutual intelligibility (Elliott et al. 2016), and typically Spanish is used as a lingua franca among speakers of the different dialects. In the Itunyoso Triqui region, Spanish is usually learned as a second language by children once they attend school and, for most younger Triqui community members, there is a stable pattern of diglossia.[5] While Triqui is the language of communication for most matters in Triqui towns, Spanish is used in both schools and in communication with non-Triqui outsiders. All generations speak Triqui fluently and use it in daily communication in Triqui towns, but some children have begun to also use Spanish even when speaking solely with other Triqui community members. Thus, the language is threatened – it rates approximately 6b on the EGIDS scale of endangerment (Lewis and Simons 2010). A large-scale language documentation project has produced approximately 30 h of transcribed recordings of the language (DiCanio 2019) alongside an online dictionary (DiCanio et al. 2020a).

## 2.2 Phonology

The segmental and tonal phonology of Itunyoso Triqui is discussed at length in DiCanio et al. (2020b) and in DiCanio (2008, 2010, 2016). Like many Mixtecan languages and other Triqui languages, Itunyoso Triqui has a complex tonal inventory, mostly disyllabic stem shape, and relatively simple syllable structure. Non-modal phonation is orthogonal to the tonal contrasts in Triqui: glottal stops surface as onsets in stem-final syllables (e.g., /ɾa³ʔaː³/ 'hand'), in pre-glottalized sonorants (e.g., /ˀnĩɦ⁴⁵/ 'corn'), and in stem-final codas (e.g., /saʔ¹/ 'good').[6]

There are nine contrastive lexical tones in the language: /1, 2, 3, 4, 45, 43, 32, 31, 13/ (5 is high, 1 is low). The level tones (/1, 2, 3, 4/) involve very little change in $F_0$ (DiCanio 2008, 2012a). The highest, rising tone /45/ is noticeably higher than the high level tone and, for the other Triqui variants, it is analyzed as an additional, fifth tonal level (Hernández Mendoza 2017; Hollenbach 1984; Longacre 1952). The falling tones /43/ and /32/ have very similar slope, but differ in $F_0$ height, a fact that may contribute to listeners' difficulty in distinguishing them in deficient contexts (DiCanio 2012b). The falling tone /31/ is quite abrupt and falls into the $F_0$ floor for most speakers. It may optionally surface with some creaky phonation (DiCanio 2008).

5 At the time of writing, many members of the community older than 50 years of age have either limited proficiency in Spanish or are functionally monolingual in Triqui.

6 There is no phonological distinction to be made between "glottalized" and "glottalization" here. Pre-glottalized sonorants or glottal stops may both be produced with full glottal closure or with creaky phonation.

Root-final syllables are accentually prominent and many phonological contrasts may only occur in this position, including (1) glottal stops and glottalization, (2) prenasalized stops, (3) nasal vowels, (4) contrastive length (only in monosyllables), and (5) the full range of vowel contrasts (DiCanio 2008, 2012c). A vastly reduced number of contrasts occur in non-final syllables in roots. In addition, root-final syllables are phonetically longer than non-final syllables regardless of the position of the word in the utterance or focus condition (DiCanio 2010; DiCanio and Hatcher 2018). This system of final prominence extends to the tonal system as well – tone is maximally contrastive in root-final syllables. Only root-final syllables may host contour tones. Moreover, for most roots, in the absence of additional inflectional morphology, a process of leftward tonal association assigns the leftmost tone on the root-final syllable to non-final syllables of the stem, for example, /tʃi.ko.ˀjo$^{3}$/ → [tʃi$^{3}$.ko$^{3}$.ˀjo:$^{3}$] 'tadpole', /nu.βi$^{43}$/ → [nu$^{4}$.βi:$^{43}$] 'church' (DiCanio 2008, 2016; DiCanio et al. 2020b). That is, non-final roots have a tonal specification entirely predictable from that of the final syllable of the root.[7] All syllables on all word types have a surface tonal specification, without exception.

All Triqui languages have a contrast in stem-final syllables among open syllables where the final vowel is long (e.g., /a$^{3}$ta:$^{3}$/ 'to load'), syllables with a coda /ʔ/ (e.g., /a$^{3}$taʔ$^{3}$/ 'to bloom'), and syllables with a coda /ɦ/ (e.g., /a$^{3}$taɦ$^{3}$/ 'to say'). Within this paper, stem-final open syllables are transcribed with a length diacritic to indicate that these final syllables are obligatorily bimoraic (DiCanio 2008, 2016; DiCanio et al. 2020b), though vowel length is also predictable when a coda is absent.[8] The coda contrast in stem-final syllables is also morphologically contrastive, for example, /a$^{3}$tʃi$^{4}$nĩ:$^{43}$/ 'to get drunk', /a$^{3}$tʃi$^{4}$nĩɦ$^{4}$/ 'I got drunk', /a$^{3}$tʃi$^{4}$nĩʔ$^{4}$/ 'we got drunk' (DiCanio 2016). While most of the tones may freely surface on open syllables or in syllables with a coda /ɦ/, only level tones surface in syllables with a coda /ʔ/ (DiCanio 2008).

## 2.3 Triqui morphophonology and tonally conditioned allomorphy

Itunyoso Triqui is canonically VSO and strictly prefixing. SVO or OVS word order is restricted to contexts where the pre-verbal argument is under narrow focus or occurs in a topicalized phrase. Verbs may be preceded by aspectual, iterative, or causative prefixes and alienably possessed nouns are preceded by a possessive prefix (this prefix is missing for inalienably possessed nouns) (DiCanio 2016, to appear), as shown in examples (1), (2), and (4). Apart from these prefixal types, the language has mostly isolating word structure. Pronominal clitics may occur on the right edge of any lexical root in the language, marking mainly person on verbs, as in (1) and (3); or the possessor on nouns, as in (4). These pronominal clitics are identical across all parts of speech – they apply even on prepositions, for example, /$^{n}$ga$^{1}$=ũɦ$^{3}$/ [with=3SF] 'with her'; /$^{n}$gaɦ$^{1}$/ [with.1S] 'with me'; and so on.

(1) ku$^{2}$-tu$^{2}$-tʃu$^{3}$ˀβiʔ$^{3}$=neɦ$^{3}$=ũɦ$^{4}$
POT-CAUS-be.scared=3P=1P.EXCL
'They are going to scare us.'

(2) n-a$^{3}$neʔ$^{3}$ ka$^{3}$to$^{4}$
ITER-be.sold shirt
'The shirt was resold.'

(3) β:ah$^{3}$=siɦ$^{3}$
go=3SM
'He is going.'

(4) si$^{3}$-kʷe$^{2}$kĩ$^{3}$=siɦ$^{3}$
POSS-onion=3SM
'his onion'

7 There are several exceptions to this, discussed in DiCanio (2008), and prefixal morphology alters non-final syllable tones as well (DiCanio to appear).

8 Vowel lengthening is found in phrase-final and non-phrase-final positions (DiCanio and Hatcher 2018).

**Table 1:** Cliticized roots in Itunyoso Triqui. The top row provides the nominal root form found outside of possessive construction for the noun 'pot' or, for the verb 'to bathe oneself', the root form found with full NP subjects. Note that the 1s, 2s, 3top, and 1du clitics modify the tonal and segmental structure of the root.

| | | | | |
|---|---|---|---|---|
| | /tʃuɦ$^{3}$/ | 'pot' | /a$^{3}$neː$^{32}$/ | 'to bathe oneself' |
| 1s | si$^{3}$-tʃuː$^{43}$ | 'my pot' | a$^{4}$neɦ$^{4}$ | 'I bathed myself' |
| 2s | si$^{3}$-tʃuɦ$^{4}$=ɾeʔ$^{1}$ | 'your pot' | a$^{3}$neː$^{1}$=ɾeʔ$^{1}$ | 'you bathed yourself' |
| 3s.m | si$^{3}$-tʃuɦ$^{3}$=siɦ$^{3}$ | 'his pot' | a$^{3}$neː$^{32}$=siɦ$^{3}$ | 'he bathed himself' |
| 3s.f | si$^{3}$-tʃuɦ$^{3}$=ũɦ$^{3}$ | 'her pot' | a$^{3}$neː$^{32}$=ũɦ$^{3}$ | 'she bathed herself' |
| 3s.anim | si$^{3}$-tʃuɦ$^{3}$=tʃuɦ$^{3}$ | 'its (anim) pot' | a$^{3}$neː$^{32}$=tʃuɦ$^{3}$ | 'it (anim) bathed itself' |
| 3s.top | si$^{3}$-tʃuɦ$^{23}$ | 'pot of aforementioned' | a$^{3}$neɦ$^{3}$ | 'the aforementioned bathed themself' |
| 1du | si$^{3}$-tʃuʔ$^{4}$ | 'our (du) pot' | a$^{3}$neʔ$^{3}$ | 'we (du) bathed ourselves' |
| 1p.excl | si$^{3}$-tʃuɦ$^{3}$=ũɦ$^{4}$ | 'our (excl) pot' | a$^{3}$neː$^{32}$=ũɦ$^{4}$ | 'we (excl) bathed ourselves' |
| 1p.incl | si$^{3}$-tʃuɦ$^{3}$=neʔ$^{4}$ | 'our (incl) pot' | a$^{3}$neː$^{32}$=neʔ$^{4}$ | 'we (incl) bathed ourselves' |
| 2p | si$^{3}$-tʃuɦ$^{3}$=a$^{3}$ni$^{2}$ʔiɦ$^{4}$=ɾeʔ$^{1}$ | 'your (p) pot' | a$^{3}$neː$^{32}$=a$^{3}$ni$^{2}$ʔiɦ$^{4}$=ɾeʔ$^{1}$ | 'you (p) bathed yourselves' |
| 3p.m | si$^{3}$-tʃuɦ$^{3}$=a$^{3}$niʔ$^{2}$=siɦ$^{3}$ | poss-pot=3p=3m<br>'their (m) pot' | a$^{3}$neː$^{32}$=a$^{3}$niʔ$^{2}$=siɦ$^{3}$ | bathe.oneself=3p=3m<br>'they (m) bathed themselves' |
| 3p.f | si$^{3}$-tʃuɦ$^{3}$=a$^{3}$niʔ$^{2}$=ũɦ$^{3}$ | poss-pot=3p=3f<br>'their (f) pot' | a$^{3}$neː$^{32}$=a$^{3}$niʔ$^{2}$=ũɦ$^{3}$ | bathe.oneself=3p=3f<br>'they (f) bathed themselves' |
| 3p.anim | si$^{3}$-tʃuɦ$^{3}$=a$^{3}$niʔ$^{2}$=tʃuɦ$^{3}$ | poss-pot=3p=3anim<br>'their (anim) pot' | a$^{3}$neː$^{32}$=a$^{3}$niʔ$^{2}$=tʃuɦ$^{3}$ | bathe.oneself=3p=3anim<br>'they (anim) bathed themselves' |

We may divide personal clitics in the language into two types: those which condition tonal changes on preceding roots and those which do not interact with the preceding root. The 1s, 2s, 3top (topic or aforementioned third person), and 1du clitics all condition tonal changes on the root morpheme. However, none of the other clitics change the phonology of the root at all. A few paradigms with the full set of clitic pronouns are provided in Table 1. Note that dual- and plural-marked words for all persons but first person are compositional, that is, a dual or plural clitic precedes the person clitic (example shown in the bottom row).

Table 1 shows that the tones of nominal and verbal roots are unaffected by any other person clitic apart from those marking 1s, 2s, 3top, 1du. The conditions determining how root tones change with these clitics are quite complex, but are fully described in DiCanio (2016) and DiCanio et al. (2020b). A crucial concern, though, is that the types of tonal changes which these specific clitics condition on roots are **not** phonologically predictable. There are several strong tendencies (see below), but many exceptions.

Important for our discussion here are the tonal changes on roots conditioned by the 2s clitic. For roots with a tone /4/ followed by a coda /ɦ/ or with final falling tones /43, 32, 31/, the clitic conditions a process of leftward low tone spreading one syllable onto the root, as shown in (5). This is also shown with the verbal example 'you bathed yourself' in Table 1, where the final syllable's falling /32/ tone is overwritten by the low tone /1/. Yet, for (most) roots with a final tone /3/, the same clitic conditions a different process – the preceding syllable raises to tone /4/, as shown in the nominal example 'your pot.' Not shown in the table are contexts where the root tone is low (tones /2, 1/) or high/rising (/4, 45/). In stems with these tones, the 2s clitic does not condition any tonal changes on roots, as shown in (6) and (7).

(5) tu$^{4}$ˀβeɦ$^{4}$ > tu$^{4}$ˀβeɦ$^{1}$=ɾeʔ$^{1}$
'to sell' > 'you are selling'

(6) a$^{3}$tʃi$^{1}$ʔiː$^{1}$ > a$^{3}$tʃi$^{1}$ʔiː$^{1}$=ɾeʔ$^{1}$
'to begin' > 'you are beginning'

(7) ta$^{3}$koɦ$^{45}$ > ta$^{3}$koɦ$^{45}$=ɾeʔ$^{1}$
'foot' > 'your foot'

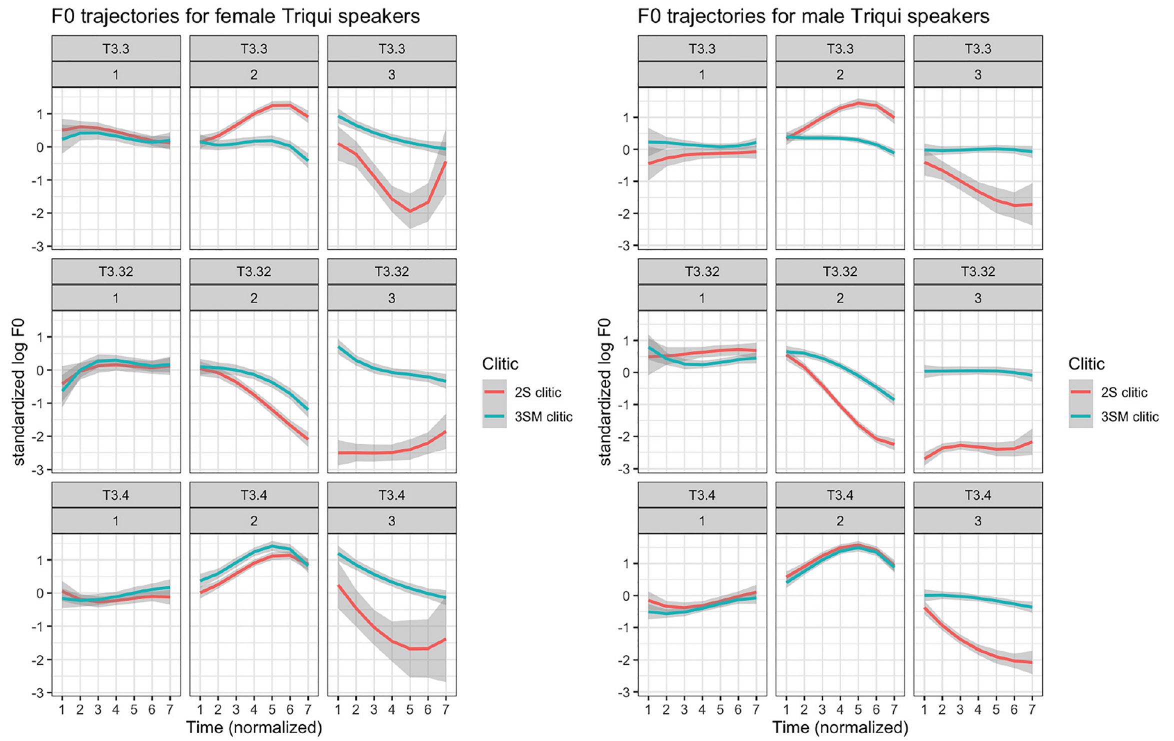


**Figure 1:** Normalized $F_0$ trajectories on stems with tonal raising (*top row*, root tone /3.3/), low tone spreading (*middle row*, root tone /3.32/), and no tonal changes (*bottom row*, root tone /3.4/), for female Triqui speakers (*left*) and male Triqui speakers (*right*). Each syllable is numbered here; for example, for the sequence [ku$^{3}$nũ$^{4}$=reʔ$^{1}$] 'you listened', the first syllable is '1', the second '2', and the clitic '3.' Each panel column represents a single syllable.

**Table 2:** The example sentences that are shown in Figure 1 for the pre-clitic root tones /3.3/, /3.32/, and /3.4/.

| Pre-clitic root tone | Sentence with underlying tone | Surface representation | Gloss |
|---|---|---|---|
| /3.3/ | /k-u$^{3}$nũ$^{3}$=reʔ$^{1}$ $^{n}$go$^{2}$ k$^{w}$e$^{4}$ntu$^{43}$/ | [ku$^{3}$nũ$^{4}$=reʔ$^{1}$ $^{n}$go$^{2}$ k$^{w}$e$^{4}$ntu$^{43}$] | 'You listened to a story.' |
| | /k-u$^{3}$nũ$^{3}$=siɦ$^{3}$ $^{n}$go$^{2}$ k$^{w}$e$^{4}$ntu$^{43}$/ | [ku$^{3}$nũ$^{3}$=siɦ$^{3}$ $^{n}$go$^{2}$ k$^{w}$e$^{4}$ntu$^{43}$] | 'He listened to a story.' |
| /3.32/ | /k-u$^{3}$nũ$^{32}$=reʔ$^{1}$ $^{n}$go$^{2}$ ja$^{3}$koʔ$^{3}$/ | [ku$^{3}$nũ$^{1}$=reʔ$^{1}$ $^{n}$go$^{2}$ ja$^{3}$koʔ$^{3}$] | 'You planted (in) a forest.' |
| | /k-u$^{3}$nũ$^{32}$=siɦ$^{3}$ $^{n}$go$^{2}$ ja$^{3}$koʔ$^{3}$/ | [ku$^{3}$nũ$^{32}$=siɦ$^{3}$ $^{n}$go$^{2}$ ja$^{3}$koʔ$^{3}$] | 'He planted (in) a forest.' |
| /3.4/ | /ru$^{3}$nũ$^{4}$=reʔ$^{1}$ $^{n}$go$^{2}$ βeʔ$^{3}$/ | [ru$^{3}$nũ$^{4}$=reʔ$^{1}$ $^{n}$go$^{2}$ βeʔ$^{3}$] | 'You painted a house.' |
| | /ru$^{3}$nũ$^{4}$=siɦ$^{3}$ $^{n}$go$^{2}$ βeʔ$^{3}$/ | [ru$^{3}$nũ$^{4}$=siɦ$^{3}$ $^{n}$go$^{2}$ βeʔ$^{3}$] | 'He painted a house.' |

The tonal realizations of the three allomorphs of the 2s clitic are shown in Figure 1 for a verb with tone /3.3/ (illustrating pre-low raising), a verb with root tone /3.32/ (illustrating low tone spreading), and a verb with tone /3.4/ (illustrating no tonal changes on the root). Four female speakers (left) and six male speakers (right) repeated the sentences shown in Table 2 four or five times each. As a comparison to the 2s clitic forms, the tonal patterns for the same exact verbs with the 3sm clitic are overlaid in each of the panels in a different color: the 2s tonal patterns are in red, while the 3sm tonal patterns are in blue.

The data in Figure 1 shows the three different tonal effects on words. These effects are persistent and common in Itunyoso Triqui. While it may seem like the tonal raising process is limited (only roots with tone /3/ undergo it), tone /3/ is vastly over-represented in the Triqui lexicon. Of the 1,471 monomorphemic roots in the lexicon, tone /3/ occurs on 31.7% of all roots (DiCanio et al. 2020a). This is a similar percentage to the total number of roots, combined, containing the falling tones (/43, 32, 31/): 28.9%. From a inflectional database of

558 inflected roots (mostly verbs and nouns), 150 (26.9%) display the raising tonal pattern with the 2s clitic (26.9%), while 246 (44.1%) show the lowering pattern.[9]

### 2.4 Reduction of the 2s clitic

A complicating factor in the production of the 2s clitic is the fact that it may be variably reduced in spontaneous speech. In addition to a fully faithful production of the clitic, there are four unique variants, listed below:

(1) The clitic /ɾeʔ$^{1}$/ will be realized with no rime, that is, as =[ɾ] ~ [ɾ̥]. The voiceless variant is common when the clitic follows final syllables with a glottal coda.
(2) Preceding the final content question particle /oʔ$^{1}$/, the clitic almost universally fuses to create the portmanteau [ɾoʔ$^{1}$], deleting the rime, for example, /ũ$^{3}$ sĩ$^{3}$ ˀjaɦ$^{4}$ ɾ-oʔ$^{1}$/ [what thing do 2s-Q] 'What are you doing?'
(3) Preceding the (common) function word /ni$^{2}$/ 'and', the clitic fuses to create a portmanteau [ti$^{2}$].
(4) The clitic may be entirely deleted; = Ø.

Full deletion (in case 4) is rather rare as a realization of the clitic, but the realizations in cases 1–3 all display a common pattern: the deletion of the syllable's rime. Importantly, the morphological outcome of potential rime deletion or clitic reduction is unique for each of the root tonal allomorphs discussed above. Were reduction to apply to roots where it conditions tonal raising or lowering processes, the root itself would retain a more significant morphological exponent of the clitic.[10] Were reduction or deletion to occur on roots where the segmental content of the clitic is the sole exponent of the 2s morpheme, then morphological information would be lost. A hypothesis predicting that morphological functional load plays a role in clitic reduction would predict greater rates of clitic reduction in the former two contexts than in the latter one. If no differences in the rates of clitic reduction across the root types are found, then functional load arguably plays no role.

## 3 Corpus analysis

### 3.1 Methods

To investigate this hypothesis, I examined the rates of 2s clitic reduction in a corpus of 65 Triqui texts (9 h of speech) from a language documentation project (DiCanio 2019).[11] These texts were all previously transcribed in ELAN (Wittenburg et al. 2006) and included the speech from 16 different native Triqui speakers. The topics of the transcribed speech texts varied. They included many conversations between individuals on local history, customs, politics, weaving, folklore, and ethnobotany. These specific texts were chosen since these comprised the spontaneous speech recordings for which the tonal transcriptions had been double-checked by the team involved in the language documentation project. Note that even when the clitic was deleted, the intended clitic was always included in the transcribed texts in parentheses – for example, ɾa$^{3}$ʔa$^{4}$(=ɾeʔ$^{1}$) 'hand=2s' – so it was possible to determine cases of full or partial reduction from the transcriptions.

All utterances containing the 2s clitic were extracted from the corpus, for a total of 481 observations. Each of these observations were coded for (a) degree of reduction (reduced variants or unreduced) and (b) the type of tonal process that the clitic triggered (tonal lowering, tonal raising, or no tonal change). A reduced production comprised either a token where the rime was missing in the production of the clitic (=[ɾ]),

9 The details of this inflectional database are described in DiCanio et al. (2020b).

10 The two other clitics which condition tonal raising in the language – the 1s and 1du – each involve glottal consonant alternations as well as tonal changes, so clitic identity would **not** be potentially neutralized like the reduction found with the 2s.

11 The documentation project was exempt from review according to the Institutional Review Board at the University at Buffalo, but all participants were still asked to provide either verbal or written consent to participate. Participants were paid a locally competitive hourly rate for recording.

as in cases 1–3 above, or where the entire syllable was missing. The decision to group reduced and deleted tokens was motivated by (a) the rarity of the second category – full deletion of the clitic occurred in just 46 of 475 words (9.7%) – and (b) the necessity to evaluate a set of binary options within logistic regression. Cases where the clitic is fully omitted and partially present were analyzed with a separate analysis (below). Six of the 481 observations were excluded from analysis because it was unclear whether the morpheme was reduced or not. In addition, the position of the clitic in the utterance was coded as an additional two-level variable (utterance-final vs. phrase-internal). The expectation is that patterns of morphological reduction might be less likely to occur when the morpheme is at the end of an utterance than when it precedes other words.

Two logistic regression models were evaluated. In the first, the dependent variable (reduced or unreduced) was evaluated with a generalized linear mixed model (glmer), fit by maximum likelihood estimation in R (R Development Core Team 2020) using the lme4 package (Bates et al. 2015) with family specified as "binomial." Two fixed effects were specified: a three-level factor *tonal process* and a two-level factor of *utterance position*, both described above. The first factor was coded with treatment/dummy contrast coding where "no tonal process" was specified as the baseline against which the tonal raising and tonal lowering contexts were compared. Utterance position received sum contrast coding. A random intercept for *word/item* was included as well. Given the stochastic nature of the contexts where this morpheme occurs in spontaneous speech, more complex models with interaction terms or more complex random effects structures did not converge. A statistically significant effect for *tonal processes* would demonstrate differences in the rate of clitic reduction across the different root types. The second model was identical to the first, but the dependent variable was set to a separate categorization of the tokens, as completely omitted versus partially/fully present. This second model evaluated if full deletion of the clitic varied by either the tonal process or sentence position.

## 3.2 Results

The three tonal processes co-occurring with the 2s clitic occurred with similar frequencies in the corpus data: 174 observations on roots with no tonal changes, 154 on roots conditioning tonal lowering, and 147 on roots conditioning tonal raising. The vast majority (452/475, or 95.2%) of clitic productions occurred phrase-internally while just 23 observations (4.8%) occurred in an utterance-final (or pre-pausal) position. The relationship between morphological context and reduction is provided in Figure 2.

Overall, reduction of the clitic was frequent in the corpus, occurring in 298 of the 475 observations (62.7%). However, the rate of reduction varied by morphological context. After roots where no tonal change occurred, 56.9% of all observations involved a reduced clitic. After roots where the clitic co-occurred with tonal lowering on the preceding stem, 61.0% of the observations involved a reduced clitic. After roots where the clitic co-occurred with tonal raising on the preceding stem, 71.4% of the observations involved the reduced clitic. The results from the mixed-effects model showed a significant effect of only this last morphological category on reduction ($z = -2.0$, $p < 0.05$) relative to the reference level (no tonal changes). No statistical difference in reduction rate was found between the allomorph conditioning no effect and the one conditioning tonal lowering on the root ($z = -0.01$, $p < 0.99$). The effect of phrasal position was also significant ($z = -3.0$, $p < 0.01$). Just 7 of the 22 productions (31.8%) of the 2s clitic were reduced in pre-pausal position whereas 291 (64.4%) of the 452 productions of the 2s clitic were reduced in phrase-medial position. Given the large differences in sample size by utterance position, however, these effects should be considered with some caution.

Full deletion of the 2s clitic, as mentioned above, was rather uncommon in the corpus, occurring in just 46 of the 475 words (9.7%). The results from the mixed-effects model showed no significant effects of tonal context on the realization of the clitic, for either the lowering context ($z = -1.7$, $p < 0.05$) or the raising context ($z = -0.7$, $p < 0.05$). Additionally, no effects of phrasal position were found ($z = 0.6$, $p < 0.05$).

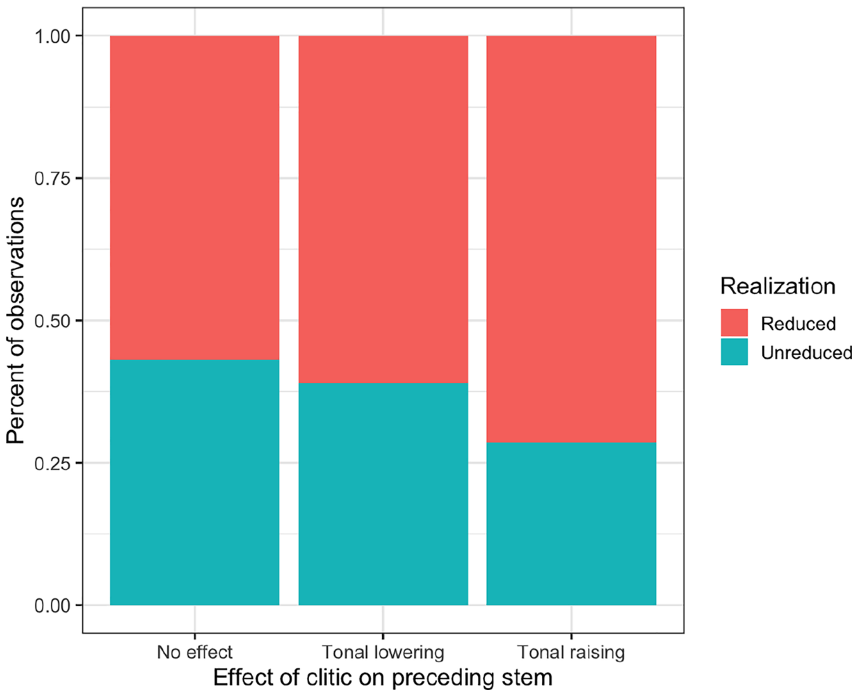


**Figure 2:** The relationship between morphological context and clitic reduction in Itunyoso Triqui: the rates of reduction of the 2s clitic by morphological context.

# 4 Discussion

For the allomorph involving tonal raising, the results from the corpus analysis confirm the functional hypothesis that reduction is more likely in contexts where it does not lead to loss of morphological contrast (Blevins and Wedel 2009; Wedel 2012; Wedel et al. 2013). Though clitic reduction occurs after each of the three root types, the rates of reduction were smallest where the root's tone was unaffected by the clitic. A complicating factor here is the lack of an effect for the tonal lowering allomorph. There are three possible, though post hoc explanations for this. The first is that there are a greater number of phonological contexts where low tone spreading occurs in Itunyoso Triqui. It occurs on roots with four possible tonal patterns on the preceding stem (/4+ɦ, 43, 32, 31/) whereas tonal raising occurs only in contexts where the preceding stem tone is the (very common) tone /3/. The latter context is a morphologically uniform environment, whereas the former is an alternating environment. Alternating morphological contexts with a number of distinct conditions can block regular sound change (Bybee 2001, 2002; Timberlake 1978). The second possible explanation is that the conditioned high tone is more acoustically salient than the process of low tone spreading. A higher preceding tone may simply be a better morphological exponent of the 2s clitic than a low tone.

The third possibility is that the process of low tone spreading with the 2s clitic may have simply emerged later in the history of the Triqui dialects than the tonal raising process. The latter is found in all three Triqui variants (DiCanio 2016; Hollenbach 1984; Hernández Mendoza 2017), but the low tone spreading process is unique to Itunyoso Triqui. Since this process is newer, the triggering morpheme for the low tone spreading may be more likely to retained. As a parallel, the tonal raising process with the 2s is more persistent in Chicahuaxtla Triqui and it is within this dialect that the same pronominal clitic, /=ɾeʔ$^{1}$/, is uniformly realized as /=t/ in non-phrase-final contexts (cf. Hernández Mendoza 2017, Ch. 8). This change of /=ɾeʔ$^{1}$/ to /=t/ in Chicahuaxtla Triqui is strongly parallel to the alternations observed between /=ɾeʔ$^{1}$/ and /=ɾ/ in Itunyoso Triqui.[12] Low tone spreading is also a general phonological process in Itunyoso Triqui (see DiCanio 2016; DiCanio et al. 2020b), unlike raising of tone /3/, which only occurs with the 2s clitic. The clitic therefore has a slightly different status for roots which undergo low tone spreading than it does for roots which do not undergo this process.

12 Note that the reduced, final flap is often devoiced in Itunyoso Triqui, [ɾ̥], suggesting even greater similarity to the Chicahuaxtla Triqui clitic alternation.

While the functional hypothesis is compelling, the alternative hypothesis is that the morphological boundary type is a predictor for the rates of deletion observed in the Triqui data, following Guy (1991). There are few reasons to accept this hypothesis, however. Unlike the patterns of [t/d]-deletion in English, there is no difference in the type of morphological boundary when the 2s clitic follows a word for which it conditions tonal lowering as opposed to tonal raising. Furthermore, the process of rime deletion or reduction is specific to the 2s clitic – there are no other processes of final vowel simplification in the language. Indeed, since stem-final syllables are stressed and carry heavy functional load in the language, stem-final syllables are often phonologically stable. Thus, unlike [t/d]-deletion, this process never applies to uninflected word forms. We can safely reject this alternative hypothesis for the Triqui data.

The pattern of reduction in Itunyoso Triqui also suggests a pathway for the evolution of tonally conditioned allomorphy. Recall the Yoloxóchitl Mixtec pattern above where the 1s enclitic pronoun is marked with a low tone on the root except in contexts where the root has a low tone. A probable historical scenario was one similar to the present-day Triqui 2s clitic: when stem-level changes co-occur as exponents of a morpheme, this context may allow the deletion of the triggering morph to proceed more often than in contexts where no stem-level tonal changes occur. This type of pattern is typologically rare (Paster 2006), but is attested in both Mixtec (Otomanguean) languages like Yoloxóchitl Mixtec and Yucunany Mixtec (Castillo García 2007; Paster 2009) and Bantoid languages like Mungbam/Munken (Lovegren 2012). Interestingly, these language families have strong structural similarities: register tonal systems containing 3–4 level tones, complex inflectional morphology realized with tonal alternations, and a strong tendency towards prefixal and/or fusional morphology with little suffixation (Good 2012, 2017; Hyman 2004; Lovegren 2013).

# 5 Conclusions

The current paper has examined how variation in speech reduction interacts with patterns of morphological exponence in sound change within a corpus of spontaneous speech from Itunyoso Triqui. The results show that speakers are more likely to reduce the 2s enclitic in contexts where this clitic conditions a process of tonal raising on the preceding stem and less likely to reduce it in contexts where no stem tonal alternations occur. This supports the hypothesis that speech reduction and processes of deletion are sensitive to the functional load of the targeted contrast and reduction is less likely when it leads to contrast neutralization (Blevins and Wedel 2009; Wedel 2012; Wedel et al. 2013). There are close similarities between the reweighting of morphological exponents in the current work and the parallel process of cue reweighting in regular sound change (Beddor 2009; Coetzee et al. 2018; Kirby 2018; Ohala 1989). In particular, uniform morphological environments (Bybee 2002; Timberlake 1978) closely resemble cues having greater distributional consistency – a pattern found with more strongly weighted acoustic cues (Coetzee et al. 2018; Holt and Lotto 2006). Moreover, we often see the outcome of autosegmental tonal stability in synchronic grammars and within morphologies (Goldsmith 1990; Yip 2002), but we rarely see the processes whereby tonal affixes evolve as the sole exponents of morphemes. The findings here provide evidence of the evolution of this process. Such results demonstrate how by examining variation of reduction in spontaneous speech in field recordings from an endangered language, we can observe the precursors of morphophonological change.

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## References

Barnes, Jonathan. 2006. *Strength and weakness at the interface: Positional neutralization in phonetics and phonology*. Berlin: Mouton de Gruyter.

Bates, Douglas, Martin Mächler, Bolker Ben & Steve Walker. 2015. Fitting linear mixed-effects models using lme4. *Journal of Statistical Software* 67(1). 1–48.

Beddor, Patrice Speeter. 2009. A coarticulatory path to sound change. *Language* 85(4). 785–821.

Blevins, Juliette & Andrew Wedel. 2009. Inhibited sound change: An evolutionary approach to lexical competition. *Diachronica* 26(2). 143–183.

Bouavichith, Dominique & Lisa Davidson. 2013. Segmental and prosodic effects on intervocalic voiced stop reduction in connected speech. *Phonetica* 70. 182–206.

Bybee, Joan. 2001. *Phonology and language use*. Cambridge: Cambridge University Press.

Bybee, Joan. 2002. Word frequency and context of use in the lexical diffusion of phonetically conditioned sound change. *Language Variation and Change* 14. 261–290.

Castillo García, Rey. 2007. *Descripción fonológica, segmental, y tonal del Mixteco de Yoloxóchitl, Guerrero*. Mexico City Centro de Investigaciones y Estudios Superiores en Antropología Social (CIESAS) MA thesis.

Coetzee, Andries W., Patrice Speeter Beddor, Kerby Shedden, Will Styler & Daan Wissing. 2018. Plosive voicing in Afrikaans: Differential cue weighting and tonogenesis. *Journal of Phonetics* 66. 185–216.

DiCanio, Christian. 2008. *The phonetics and phonology of San Martín Itunyoso Trique*. Berkeley: University of California Berkeley dissertation.

DiCanio, Christian. 2010. Illustrations of the IPA: San Martín Itunyoso Trique. *Journal of the International Phonetic Association* 40(2). 227–238.

DiCanio, Christian. 2012a. Coarticulation between tone and glottal consonants in Itunyoso Trique. *Journal of Phonetics* 40(1). 162–176.

DiCanio, Christian. 2012b. Cross-linguistic perception of Itunyoso Trique tone. *Journal of Phonetics* 40. 672–688.

DiCanio, Christian. 2012c. The phonetics of Fortis and Lenis consonants in Itunyoso Trique. *International Journal of American Linguistics* 78(2). 239–272.

DiCanio, Christian. 2016. Abstract and concrete tonal classes in Itunyoso Trique person morphology. In Enrique Palancar & Jean-Léo Léonard (eds.), *Tone and inflection: New facts and new perspectives*, 225–266. Berlin: De Gruyter Mouton.

DiCanio, Christian. 2019. Itunyoso Triqui Collection of Christian DiCanio. The Archive of the Indigenous languages of Latin America (www.ailla.utexas.org). Available at: https://ailla.utexas.org/islandora/object/ailla%3A243683.

DiCanio, Christian. to appear. Aspecto verbal en triqui de Itunyoso. In Michael Swanton, Marcela San Giacomo Trinidad & Fidel Hernández Mendoza (eds.), *Estudios fonológicos de idiomas mixtecanas*. Universidad Nacional Autónoma de México.

DiCanio, Christian, Jonathan D. Amith & Rey Castillo García. 2014. The phonetics of moraic alignment in Yoloxóchitl Mixtec. In Carlos Gussenhoven, Yiya Chen & Dan Dediu (eds.), *Proceedings of the 4th tonal aspects of language symposium*, Nijmegen, the Netherlands, 203–210. ISCA Archive. Available at: http://www.isca-speech.org/archive/tal_2014.

DiCanio, Christian & Richard Hatcher. 2018. On the non-universality of intonation: Evidence from Triqui. *Journal of the Acoustical Society of America* 144. 1941.

DiCanio, Christian, Basileo Martínez Cruz, Benigno Cruz Martínez & Wilibaldo Martínez Cruz. 2020a. *Diccionario bilingüe – triqui de itunyoso y castellano*. Available at: http://www.acsu.buffalo.edu/~cdicanio/Diccionario_Triqui_01-08-20.xhtml.

DiCanio, Christian, Basileo Martínez Cruz, Benigno Cruz Martínez & Wilibaldo Martínez Cruz. 2020b. Glottal toggling in Itunyoso Triqui. *Phonological Data & Analysis* 2(4). 1–28.

Elliott, A. Ray, Jerold A. Edmondson & Fausto Sandoval Cruz. 2016. Illustrations of the IPA: Chicahuaxtla Triqui. *Journal of the International Phonetic Association* 46(3). 351–365.

Goldsmith, John. 1990. *Autosegmental and metrical phonology*. Oxford: Blackwell.

Good, Jeff. 2012. How to become a "Kwa" noun. *Morphology* 22(2). 293–335.

Good, Jeff. 2017. Niger-Congo languages. In Raymond Hickey (ed.), *The Cambridge handbook of areal linguistics*, 471–499. Cambridge: Cambridge University Press.

Gurevich, Naomi. 2004. *Lenition and contrast: The functional consequences of certain phonetically conditioned sound changes*. New York: Garland.

Gurevich, Naomi. 2011. Lenition. In Marc van Oostendorp, Colin J. Ewen, Elizabeth V. Hume & Keren Rice (eds.), *Blackwell companion in phonology*, vol. 3, 1559–1575. Malden, MA: Wiley-Blackwell.

Guy, Gregory R. 1991. Explanation in variable phonology: An exponential model of morphological constraints. *Language Variation and Change* 3. 1–22.

Harris, Alice. 2017. *Multiple exponence*. Oxford: Oxford University Press.

Hernández Mendoza, Fidel. 2017. *Tono y fonología segmental en el triqui de chicahuaxtla*. Mexico City: Universidad Nacional Autónoma de México dissertation.

Hollenbach, Barbara E. 1984. *The phonology and morphology of tone and laryngeals in Copala Trique*. Tucson: University of Arizona dissertation.

Hollenbach, Barbara E. 2004. *Gramática popular del triqui de Copala. Mexico City*. Mexico: Summer Institute of Linguistics.

Holt, Lori L. & Andrew J. Lotto. 2006. Cue weighting in auditory categorization: Implications for first and second language acquisition. *Journal of the Acoustical Society of America* 119(5). 3059–3071.

Hyman, Larry M. 2004. How to become a “Kwa” verb. *The Journal of West African Languages* 30(2). 69–88.

Kirby, James P. 2018. Onset pitch perturbations and the cross-linguistic implementation of voicing: Evidence from tonal and non-tonal languages. *Journal of Phonetics* 71. 326–354.

Lavoie, Lisa M. 2001. *Consonant strength: Phonological patterns and phonetic manifestations*. New York: Garland.

Lewis, M. Paul & Gary F. Simons. 2010. Assessing endangerment: Expanding Fishman’s GIDS. *Revue Roumaine de Linguistique, Bucureşti* 2. 103–120.

Longacre, Robert E. 1952. Five phonemic pitch levels in Trique. *Acta Linguistica* 7. 62–81.

Lovegren, Jesse. 2012. Suppletive (?) tonal alternations in Munken nouns. In *LSA Annual Meeting extended abstracts (online)*, vol. 3, 1–5. Linguistic Society of America.

Lovegren, Jesse. 2013. *Mungbam grammar*. Buffalo: University at Buffalo dissertation.

McKendry, Inga. 2013. *Tonal association, prominence, and prosodic structure in south-eastern Nochixtlán Mixtec*. Edinburgh: University of Edinburgh dissertation.

Morpurgo Davies, Anna. 2012. Phonetic laws, language diffusion, and drift: The loss of sibilants in the Greek dialects of the first millennium BC. In Philomen Probert & Andreas Willi (eds.), *Laws and rules in Indo-European*, 102–121. Oxford: Oxford University Press.

Ohala, John J. 1989. Sound change is drawn from a pool of synchronic variation. In L. E. Breivik & Ernst Håkon Jahr (eds.), *Language change: Contributions to the study of its causes*. Berlin: Mouton de Gruyter.

Palancar, Enrique L., Jonathan D. Amith & Rey Castillo García. 2016. Verbal inflection in Yoloxóchitl Mixtec. In Enrique L. Palancar & Jean-Léo Léonard (eds.), *Tone and inflection: New facts and new perspectives*, 295–336. Berlin: Mouton de Gruyter.

Parrell, Benjamin & Shrikanth Narayanan. 2018. Explaining coronal reduction: Prosodic structure and articulatory posture. *Phonetica* 75. 151–181.

Paster, Mary. 2006. *Phonological conditions on affixation*. Berkeley: University of California Berkeley dissertation.

Paster, Mary. 2009. Explaining phonological conditions on affixation: Evidence from suppletive allomorphy and affix ordering. *Word Structure* 2(1). 18–47.

R Development Core Team. 2020. *R: A language and environment for statistical computing*. Austria: R Foundation for Statistical Computing Vienna Version 3.6.3, Available at: http://www.R-project.org/.

Raffelsiefen, Renate. 2000. Constraints on schwa apocope in Middle High German. In Aditi Lahiri (ed.), *Analogy, levelling, markedness: Principles of change in phonology and morphology*, 125–170. Berlin: Mouton de Gruyter.

Thomas, Erik R. 2007. Phonological and phonetic characteristics of African American Vernacular English. *Language and Linguistics Compass* 1(5). 450–475.

Timberlake, Alan. 1978. Uniform and alternating environments in phonological change. *Folia Slavica* 2. 312–328.

Wedel, Andrew. 2012. Lexical contrast maintenance and the organization of sublexical contrast systems. *Language and Cognition* 4(4). 319–355.

Wedel, Andrew, Abby Kaplan & Scott Jackson. 2013. High functional load inhibits phonological contrast loss: A corpus study. *Cognition* 128(2). 179–186.

Wittenburg, P, H. Brugman, A. Russel, A. Klassman & H. Sloetjes. 2006. *ELAN: A professional framework for multimodality research. Nijmegen: Max Planck Institute for Psycholinguistics, The Language Archive*. Available at: http://tla.mpi.nl/tools/tla-tools/elan/.

Wolfram, Walt & Erik R. Thomas. 2002. *The development of African American English*. Oxford: Blackwell.

Yip, Moira. 2002. *Tone*. Cambridge: Cambridge University Press.