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Segmental effects on (de)gemination in Western Gurage

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0. Introduction

There is a curious interplay between the nature of the final root consonant and a voicing alternation of the preceding consonant in some Western Gurage¹ (South Ethiopian Semitic) dialects. In some verbs, the penultimate root consonant is voiceless in the perfective, but voiced in the imperfective (1a). Yet in other verbs, there is no alternation (1b). Examples are from Chaha, and are given in the 3rd person masculine singular form.

(1)	Perfective	Imperfective	
a.	sətəβ-ə-m	ji-səd̪iβ	'curse'
b.	gəd̪əf-ə-m	ji-gəd̪if	'break the fast'

Banksira (2000) established that the devoicing of the penultimate root consonant in the perfective of verbs such as (1a) is dependent on the final root consonant. He proposed that final consonants unspecified for laryngeal features condition loss of voicing in the penultimate consonant. In this paper, we argue that this account is untenable for other Western Gurage dialects, Inor, Gyeto and Endegeñ. Instead, we provide a historical account that relies on the phonetic duration of the final consonant. Specifically, the penultimate consonant in question was historically a geminate which degeminated, but degemination was blocked if the final root consonant had short phonetic duration, as in (1a). Remaining geminates were devoiced and then simplified, giving rise to the voicing alternation. This is a surprising and important result, as degemination has the hallmarks of a phonological effect, but yet it is constrained by phonetic detail.

1. Chaha Data

We begin in (2) by illustrating the pattern in Chaha, the best-described dialect (Banksira 2000). Penultimate obstruents alternate between voiced and voiceless.

¹ The Western Gurage dialects are spoken approximately 180 kilometers southwest of Addis Ababa. Western Gurage includes the dialects Chaha, Inor, Ezha, Gyeto and Endegeñ; Masqan and Muher are also sometimes classified within the Western Gurage group (Leslau 1969).

(2)	Root	Perfective	Imperfective Jussive		
a.	/gza/	gəsa-m	ji-gəza	jə-gza	'own, buy'
b.	/dβr/ ²	dəpər-ə-m	ji-dəβir	jə-dβir	'add'
c.	/sdβ/	sətəβ-ə-m	ji-sədīβ	jə-sdīβ	'curse'
d.	/zgr/	zəkər-ə-m	ji-zəgir	jə-zgir	'jump'
e.	/grdm/	girətəm-ə-m	ji-grətim	jə-gərdim	'plough'
f.	/drgr/	dirəkər-ə-m	ji-drəkir	jə-dəngir	'throw carelessly'

In 'Type A' trilateral verbs³, the perfective penult is voiceless whereas the imperfective and jussive penult are voiced obstruents (2a-d). In quadrilaterals, the perfective and imperfective penult is voiceless, whereas the jussive penult is voiced (2e-f).

Unlike the verbs in (2), some verbs have a consistent voiced obstruent throughout the paradigm (3a-b). In addition, voiceless obstruents and sonorants do not alternate (3c-d).

(3)	Root	Perfective	Imperfective	Jussive	
a.	/gdf/	gədf-ə-m	ji-gədf	jə-gdf	'break thefast'
b.	/rzk'/	nəzək'-ə-m	ji-rəzik'	jə-nzik'	'be fortunate'
c.	/ktf/	kətəf-ə-m	ji-kətʃ	jə-ktif	'chop (meat)'
d.	/k'ms/	k'əməs-ə-m	ji-k'əms	jə-k'im	'taste'

The non-alternating verbs are not a set of lexical exceptions, as previously assumed (Leslau 1979, McCarthy 1986). The pattern first noticed by Banksira (2000) is that if the final root segment is a sonorant or [t], the penult in the perfective (and the imperfective if the verb is quadrilateral) is devoiced if obstruent. If the final root segment is a fricative, ejective or voiced stop, there is no alternation. Penultimate voiceless obstruents are unaffected and penultimate sonorants remain voiced. The main pattern is summarized below. The jussive penult provides the clue as to whether the root has a voiced obstruent or not:

(4) Jussive Penult	Final root segment	Perfective Penult
voiced obstruent	[r β m w j t a (x)] ⁴	voiceless obstruent as in (2)
voiced obstruent	[t' k' f s z d g]	voiced obstruent as in (3a-b)

² [β] is actually a sonorant in Chaha, a fact convincingly argued by Banksira (2000), but alternates with obstruent [p].

³ Type A is a lexical conjugation class and the least phonologically opaque of the verb types in Chaha. See Banksira (2000) for details.

⁴ There is only one verb *mesaxəm* 'chew, ruminant' that seems to condition devoicing. It has no alternations in the paradigm, but related dialects show a voiced penult [z]: ex. *Ezha məzzaxəm*.

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Before trying to make sense of the peculiar segment classes shown in (4) for the final root segment, we discuss the historical motivation for the alternations: templatic gemination of the positions where devoicing occurs.

2. The Historical Motivation

It is uncontroversial that penultimate devoicing in Chaha affects consonants that were historically geminate (Leslau 1948). Western Gurage dialects divide into three groups with respect to gemination. Ezha, Masqan and Muher⁵ show gemination. Endegeñ also has gemination, but its geminate obstruents are devoiced, and Chaha, Gyeto and Inor have no gemination, but like Endegeñ have a devoiced obstruent in the penultimate position. The cognate root 'curse' is illustrated below across four of the dialects. The Endegeñ data are taken from Leslau (1976, 1978, 1979) and the Inor data from Chamora (1997). Ezha and Chaha data are from our own field notes or Leslau (1967) and Banksira (2000).

(5)	Root	Language	Perfective	Imperfective	Jussive
	/sdβ/	Ezha	sə dd əβ-ə-m	ji-sə d iβ	jə-s d iβ
	'curse'	Endegeñ	sə tt əβ-ə	i-sə d iβ	ə-s d iβ
		Inor	sə t əβ-ə	ji-sə d iβ	ə-s d iβ
		Chaha	sə t əβ-ə-m	ji-sə d iβ	jə-s d iβ

As discussed in Ohala & Riordan (1979), maintaining vocal fold vibration during a prolonged constriction is articulatorily difficult, so geminate obstruents have a tendency to devoice. Based on this tendency, we surmise that Ezha represents the historical form, and that in Endegeñ, Chaha, Gyeto and Inor, devoicing of the penult geminate occurred. In the latter three dialects this geminate was ultimately simplified. This is outlined in (6), and forms the first part of our analysis. The three stages correspond to attested modern dialects.

(6) **Part 1 of analysis:**

Historical form	*səddəβ	(= current Ezha)
Geminate devoicing	səttəβ	(= current Endegeñ)
Degemination	sətəβ	(= current Chaha, Gyeto, Inor)

Such a scenario is uncontroversially assumed by most researchers working on Gurage. They differ in whether geminates are assumed synchronically in the underlying representation and then simplified on the surface (e.g. Lowenstamm

⁵ The classification of Masqan and Muher as Western Gurage is controversial. See Leslau (1969) and Hetzron (1972, 1977). For this reason, we will concentrate on Ezha as the 'geminating' dialect for the remainder of the paper.

1996, Banksira 2000), or whether they have only a diachronic status as we will assume here.

3. Segmental effects of final root consonant–synchronic licensing of [voice]

We now return to the question of why the peculiar sets of final consonants in (4) should affect devoicing of the penult. Banksira (2000) proposes that the final consonant has a *direct* connection to devoicing. In his account, the laryngeal specification of the final segment affects the licensing of the feature [voice] on the penult geminate. Let us consider again the set of final consonants and their division into classes which trigger or do not trigger penultimate devoicing.

(7) Chaha final consonant classes

Non-Trigger Class: [t' k' f s z d g]

Trigger Class: [r β m w j a t] ([a] < *ʔ h ɦ ʕ)⁶

Banksira (2000) adopts privative phonological features with underspecification. Given this model, segments in the Non-Trigger Class have laryngeal specification. Ejectives are [constricted glottis], voiceless fricatives are specified with [spread glottis] (a view supported by Vaux (1998) for other languages), and voiced obstruents are specified [voice]. In contrast, the segments in the Trigger Class are laryngeally unspecified segments. Sonorants lack a [voice] specification. Banksira argues that [k] is underlyingly /x/ and draws no firm conclusions about its status in the group. This leaves /t/ as the only other obstruent lacking a voicing specification.

The relationship between the laryngeal specification of the final root segment and the penultimate geminate is expressed with a constraint: 'No Doubly Linked Final [voice]' (Banksira 2000:77), where 'final' corresponds to the rightmost specification in the stem. If the consonant to the right of the geminate has Laryngeal specification, no devoicing occurs, as shown in (8) for two verbs.

(8) Non-Trigger Class

n ə zz ə k' --> nəzzək'-

√ |
 Lar Lar
 | |
 [voice] [cg]

Trigger Class

s ə bb ə r --> səppər-

√
 Lar
 |
 [voice]

Banksira assumes that there are underlying geminates in modern-day Chaha, but that they are simplified on the surface, as shown in the sample derivation in (9).

⁶ The segment [a] occurs in verbs whose final root consonant was a guttural, one of the set /ʔ h ɦ ʕ/. In Inor, Endegen, and Gyeto, the /ʔ/ is still found.

(9)	Underlying Form	/səbbər-ə-m/	/nəzzək'-ə-m/
	Geminate devoicing	səppər-ə-m	<i>does not violate constraint</i>
	Degemination	səpər-ə-m	nəzək'-ə-m
	Surface Form	[səpər-ə-m]	[nəzək'-ə-m]

While the synchronic licensing approach handles the Chaha data, the analysis fails to extend to the closely related dialects Inor, Gyeto and Endegeñ, in which the voiced stops [d g] are members of the Trigger Class for penult devoicing. In order to apply the laryngeal licensing account to these dialects, [d g] would need to be unspecified for [voice], but [z] would not. Yet [d g] contrast with both ejectives and voiceless stops, so to maintain the laryngeal licensing account, one would have to resort to language specific specification, despite similar inventories.

It turns out that Chaha is the most opaque dialect to examine in trying to make sense of the devoicing problem. The effect of the final consonant becomes clear when we examine the other dialects.

4. Segmental effect of final root consonant - impact on historical gemination

In Inor, Endegeñ and Gyeto, the two classes of final consonants are divided as follows:

(10) Inor, Endegeñ, Gyeto

Non-Trigger Class (prevents devoicing of penult): [t' k' f s z]

Trigger Class (allows devoicing of penult): [r β m w j a t' d g]

These dialects differ from Chaha in the inclusion of the voiced stops [d g] in the Trigger Class, along with [ʔ], which does not occur in Chaha. The triggering behavior of three final consonants ([f r d]) is shown in (11).

(11)	'sting'	'jump'	'touch'
Ezha	nə <u>dd</u> əf-ə-m	zə <u>gg</u> ər-ə-m	nə <u>gg</u> əd-ə-m
Endegeñ	nə <u>d</u> əf-ə	zə <u>kk</u> ər-ə	nə <u>kk</u> əd-ə
Inor	nə <u>d</u> əf-ə	zə <u>k</u> ər-ə	nə <u>k</u> əd-ə
Chaha	nə <u>d</u> əf-ə-m	zə <u>k</u> ər-ə-m	nə <u>g</u> əd-ə-m

The final consonant [f] in the verb 'sting', a member of the Non-Trigger Class, does not cause devoicing of the penult in any of the dialects. The final consonant [r] in

the verb 'jump' is a member of the Trigger Class and triggers devoicing in Endegeñ, Inor and Chaha. The final [d] in the verb 'touch' causes devoicing in Endegeñ and Inor (where it is a Trigger), but not in Chaha (where it is a Non-Trigger).

A further point to note is that in Endegeñ, the devoiced penult is geminate, whereas the voiced penult is singleton. In fact, there is a strong predictive relationship between gemination and the two Classes identified in (10), irrespective of devoicing. If the final consonant is a member of the Non-Trigger class, the penult is singleton, but if the final consonant is a member of the Trigger class, the penult is geminate. This is shown in (12) with penults that do not devoice. The final consonants [k' f] are members of the Non-Trigger Class and co-occur with singleton penults (12a), whereas the final consonants [r ?] are members of the Trigger Class and co-occur with geminates (12b):

- (12) a. **Non-Trigger Class - singleton penult**
 nət'ək'ə 'snatch away'
 k'ənəf-ə 'hit with a stick'
- b. **Trigger Class - geminate penult**
 gəffər-ə 'release'
 sənnəʔ-ə 'steal'

Problematic for the laryngeal licensing analysis is the fact that two [constricted glottis] segments, [k'] and [ʔ] occur in different classes. More importantly, given that laryngeal licensing pertains only to devoicing, the relationship between the final consonants and the presence of penultimate gemination would have to be treated separately. We contend, however, that they are crucially connected.

While there is no set of phonological features that cleanly distinguish the Trigger and Non-Trigger classes, the two groups do form natural phonetic classes in terms of their duration. As laboratory measurements bear out, the segments in the Non-Trigger Class are all longer than those in the Trigger Class. We propose that, rather than affecting *devoicing* directly as argued by Banksira (2000), the final consonant influenced the preservation or loss of penultimate gemination. Indeed, Leslau (1976) observes that gemination in Endegeñ as shown in (12) is 'phonetically conditioned' and remarks on the short duration of [r] in this respect. The penult degeminated in verbs with relatively longer final segments, but if the final segment was short, gemination (basically increased duration of a segment) was maintained to avoid compromising some minimal duration constraint on the stem.⁷ Voiced obstruent geminates were subsequently devoiced, and eventually simplified in Inor, Gyeto and Chaha.

⁷ There are two ways of interpreting degemination. One possibility is that a constraint against two long segments (a geminate and a long consonant) triggered degemination. Constraints on two geminates in a word have been reported for Latin and Japanese (Itô & Mester 1998, Suzuki 1998),

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Evidence from Ezha supports the contention that duration of the final consonant can condition gemination of the penult. In a form that is unique in Semitic, Ezha jussives typically have a geminated penult if the final consonant is [r] (Leslau 1967), as shown in (13) with Chaha jussive forms for reference.

(13)	Ezha	Chaha	
a.	jə- fikk 'ər	jə- fk 'ər	'be fat'
b.	jə- miggər	jə- mgər	'suppurate'
cf. c.	jə- nfəs	jə- nfəs	'blow (wind)'

We note that [r] is the shortest consonant in the language, and that the presence of final [r] seems to evoke gemination of the penultimate consonant, an alternation without historical precedent. This shows that the final consonant *can* condition the presence of gemination, even without regard to whether the resulting geminate is ever devoiced. This is precisely what we are arguing for in the other dialects.

Let us now consider the exact duration of Trigger and Non-Trigger segments obtained through phonetic measurement. We recorded a 30-year-old male speaker of Chaha using a Sony professional tape recorder. A wordlist of third-person masculine singular perfective verb forms was constructed. This form has the shape CəCəC- with final suffixes -ə-m, (e.g., [kəfətəm]). The target final consonant was in intervocalic position as the onset of an unstressed syllable, and we obtained three tokens of each consonant. Sonorants and fricatives were measured from the loss of vowel formants until their return after the segments. Two measurements were taken for stops corresponding to the closure period and the burst. These were added together to obtain the overall measurement. This is crucial, since it distinguishes ejectives from regular voiceless stops. Although the latter have some degree of aspiration, the ejective burst is significantly longer.

The average duration results are presented in table (14)⁸:

but these cases involve phonological dissimilations and depend on similar structure (mora count or skeletal positions), whereas the Western Gurage case involves interplay for phonetic duration. The other possibility is that degemination has an independent motivation, but was blocked when the final consonant was short to maintain a minimal duration. This seems the most plausible scenario for Western Gurage, given the Ezha jussive facts discussed in this section. Of course, we recognize that establishing that duration threshold is difficult due to the fact that consonants have different intrinsic durations when geminate.

⁸ Several consonants could not be measured. The segment [ʔ] does not occur in Chaha. We did not have access to speakers of other Gurage dialects, so we were not able to obtain measurements of this segment. We assume, however, that its duration would be short. The glides [j w] do not occur in final position of the verb stem. Finally, [x] patterns like the other fricatives, making it relatively long. However, it was historically *k, and as such would have patterned with the other voiceless stop [t] in conditioning degemination and therefore devoicing. As mentioned earlier, however, there is only one verb which might indicate its Trigger class membership.

(14)	Non-Trigger Consonant	Duration	Trigger Consonant	Duration
	ejectives [t' k']	118 ms	voiceless stops [t k]	90 ms
	fricatives [z f s]	116	voiced stops [d g]	73
			sonorants [β m]	70
			liquid [r]	30

The Non-Trigger Class are longer than 115 ms, while the Trigger Class are shorter than 90 ms, a difference of 25 ms, which is significant.

Part 2 of our analysis incorporates the effects of the final consonant on degemination. First, degemination applied, but was *blocked* in verbs with short final segments. Devoicing applied to the remaining voiced obstruent geminates, i.e. those followed by a short segment. At a later stage, degemination was applied across the board, leveling the paradigm. This is illustrated in (15).

(15) **Part 2 of analysis**

Historical form	*səbbər	*nəddəf
Degemination 1	<i>blocked</i>	nədəf
Geminate Devoicing	səppər	— (=Endegeñ)
Degemination 2	səpər	nədəf(=Chaha, Gyeto, Inor)

We emphasize that the duration of the final consonant cannot be equated with mora count. Such an analysis fails for several reasons. First, due to inflectional verb suffixes, the final consonant appears as an onset in roughly half the forms, as shown here, and a coda in the other half of the paradigm, ex. *nədəf-nə-m* 'we stung'; all forms act identically with regard to the alternations we are describing. Second, the final consonant of Semitic verb stems is usually analyzed as lacking a mora (McCarthy and Prince 1990). Third, Zec (1995) shows that sonorants are more likely to bear moras than obstruents, but the final consonants which act to maintain gemination include the sonorants, exactly the opposite effect of what would be expected if moraic count were the relevant consideration.

5. What about [d g] in Chaha?

Even though they are relatively short, the segments [d g] appear to belong to the Non-Trigger Class in Chaha. In the other dialects, they are clearly in the Trigger Class (compare the cognates for 'touch' from (11) *nəkkəd-ə* in Endegeñ, *nəkəd-ə* in Inor, but *nəqəd-ə-m* in Chaha.) We hypothesize that the difference between the dialects is not a difference of the class into which [d g] fall, but rather whether or not the geminates which remained before [d g] could be devoiced.

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Western Gurage dialects have a tendency towards *laryngeal agreement*, a requirement that (primarily adjacent) coronal and velar stops in a root match for laryngeal features (Leslau 1979, Banksira 2000, Rose & Walker 2000). As shown in (16), cognate words in the related language Amharic with a mix of ejectives and voiced stops agree in laryngeal specification in Chaha. This pattern of laryngeal agreement was leftward—the laryngeal specification ([constricted glottis] or [voice]) of the rightmost consonant caused the consonant to the left to match.

(16)	Amharic	Chaha	
	<u>k</u> 'ida	gida	'draw liquid!'
	mit' <u>ad</u>	midad	'griddle'
	<u>d</u> ik'ək'	t'ik'ək'	'be crushed, be ground!'

There is no evidence among cognate examples that voiceless segments trigger agreement. In fact, penults which are in fact devoiced do not in turn trigger devoicing of a voiced consonant to their left, e.g., the root /gɗr/ is *jigədīr* in the imperfective and *gətərəm* in the perfective. This result is consistent with the view in Lombardi (1995) and others that laryngeal features are privative, so that voiceless consonants cannot trigger agreement in the consonant to their left (since they have no laryngeal features to agree with), but they may receive a [voice] specification through assimilation or distance agreement.

Our proposal is that verbs with final [d g] maintained gemination in Chaha, just as in all the other dialects. However, because of laryngeal agreement, the geminates could not be devoiced in Chaha. The requirement for the penult to agree in laryngeal features with the final consonant outweighed the pressure for the geminate to devoice in Chaha, whereas in the other dialects, the laryngeal agreement was ignored in favor of devoicing. In an Optimality Theoretic grammar, this could be modeled as alternate ranking between two constraints. When all the geminates were simplified to singletons, only penults before [d g] maintained voicing in Chaha in spite of previous gemination. This gives the appearance that they are members of the class that allowed previous degemination in Chaha. This historical derivation is illustrated in (17).

(17) **Part 3 of analysis**

	Endegeñ	Inor, Gyeto	Chaha
Historical form	*nəggədə	*nəggədə	*nəggədəm
Degemination 1	<i>blocked in all dialects because of short final C</i>		
Geminate Devoicing	nəkkədə	nəkkədə	<i>blocked by laryngeal agreement</i>
Degemination 2	—	nəkədə	nəgədəm
	[nəkkədə]	[nəkədə]	[nəgədəm]

With this final piece of the puzzle, our analysis is complete. In the next section we provide answers to some possible criticisms of this analysis.

6. Additional considerations

6.1 Why two rounds of degemination?

Perhaps the first criticism that could be leveled at our analysis is that it relies on two distinct rounds of degemination, one of which is sensitive to the duration of the final root consonant, and another which applies across the board. However, the first context-sensitive round of degemination is clearly required for the dialect Endegeñ, so that verbs with short final consonants maintain surface gemination and verbs with long final consonants do not. Given that Endegeñ requires an episode of degemination which is sensitive to the duration of final consonants, and that this duration-sensitive degemination explains the voicing alternations in the other dialects, the principle of economy argues for the inclusion of this episode of degemination in all dialects, and a second round of across-the-board degemination in those dialects which lack surface geminates, as a means of paradigm leveling.

6.2 Why assume that the Trigger Class verbs ever had a geminate?

A second possible criticism involves our conclusion that all penults were historically geminate, even those which show no surface alternation which would suggest historical gemination (the forms which under our analysis underwent the first round of degemination). This conclusion is based on two arguments. The first, which we have already mentioned, is that all penults are geminate in related dialects which maintain surface gemination without alternations. Admittedly, this argument relies on data from related dialects and nothing internal to the dialects we are treating. The second argument is more compelling. There is a systematic alternation between the continuants [β x r] and the stops [b x n] with the stops appearing in the penult of the perfective, and the continuants elsewhere.⁹ This alternation is illustrated in (18) for Chaha.

(18)	Root	Perfective	Imperfective	Jussive	
a.	/t'βs/	t'ə β s-ə-m	ji-t'əβs	jə-t'ɪβs	'roast'
b.	/mkr/	məkə r -ə-m	ji-məxir	jə-mxir	'advise'
c.	/k'nf/	k'ənə f -ə-m	ji-k'ərf	jə-k'irf	'strike sth down'

We view this alternation as another example of the well-established resistance by geminates to lenition, as discussed in Kirchner (2000). Given that these forms were historically geminate, the stops can be explained as the historical residue of geminate-blocked lenition. Without historical gemination, there is no explanation

⁹ Like many generalizations in these languages, this is an oversimplification. The stops appear in other places as well, as a result of a number of interacting constraints. See Banksira (2000) for a complete account.

for the stops in this location. Note that this stop alternation affects verbs even if they do not (as in 18a) also undergo devoicing.

7. Conclusion

In conclusion, we have shown that the loss or retention of templatic gemination of the penultimate root consonant in some Western Gurage dialects (Chaha, Gyeto, Inor, Endegeñ) was originally conditioned by the final root segment. Short segments (sonorants and stops) disfavored degemination, while longer segments (fricatives and ejectives) allowed it. Subsequently, geminates were devoiced and geminates were later simplified to singletons in Chaha, Gyeto, and Inor. In contrast to the other dialects, Chaha did not devoice geminates in verbs with final root voiced stops due to the overriding effect of laryngeal agreement, an independently motivated construct.

On both theoretical and empirical grounds, our diachronic account should be preferred to the laryngeal licensing account which Banksira (2000) proposes for the synchronic grammar of Chaha. First, all aspects of our account are independently motivated, in contrast to Banksira's constraint 'No Doubly Linked Final [voice]', which is tailor-made for the alternation in question. Second, unlike Banksira's our diachronic approach can account for all four dialects.

Finally, there are a number of questions which we have not attempted to resolve and which remain for future inquiry. First, as we have been careful to couch our account in diachronic terms, there is a very real question about what the synchronic grammar of these languages must look like, and how much of the history should be included in the synchronic grammar. Perhaps as importantly, there remains a fundamental theoretical question about the relationship of this phonetic duration effect to the morphophonology. It calls into question the intrinsic connection between moras and phonetic duration that has been advocated for other languages (e.g. Hubbard 1994, Broselow et al 1997). Finally, we have yet to explore whether the duration interplay we have identified is related to the templatic nature of the languages involved.

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