Realize Morpheme in Kaqchikel*

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1 Introduction

Prosodic minimality is a well-established phenomenon. Processes of elision may be blocked if their application would take a word below some minimal size, typically a bimoraic foot. Minimality may also trigger augmentation processes to bring a prosodically deficient structure up to the required minimum. Both of these blocking and triggering actions are found in Lardil (Prince and Smolensky 2004, based on Hale 1973). In this squib we document a case of morphemic minimality in the Mayan language Kaqchikel. A couple of elision processes are blocked just in case they would result in zero exponence for a morpheme. The phenomenon thus falls under the OT constraint Realize Morpheme (RM). Most discussions of RM in the OT literature (Akinlabi 1996, Kurisu 2001) have been concerned with forcing the autosegmental attachment of floating features or otherwise unmotivated departures from faithfulness in order to model processual morphology such as German umlaut. They thus concern the "triggering" function of the RM constraint. We are not aware of any discussion of the "blocking" effect of RM. Hence, Kaqchikel provides novel evidence for this other facet of the constraint.

The phenomenon under discussion arises in the inflectional morphology of the language. As in most Mayan languages, pronominal arguments are marked by two different affixal agreement series in Kaqchikel. Both are prefixal. The A series encodes possessors on nominals and the transitive subject on verbs. The B series marks the subject of an intransitive verb as well as the object of a transitive verb. Unlike in some other Mayan languages, there are no suffixes marking arguments in Kaqchikel. Our discussion focuses on the A series. Section 2 develops the basic analysis on the basis of alternations in the nouns while the following section extends it to the verbs. Section 4 considers the effect of an optional u ≈ 0 alternation. In section 5 we examine some dialectal variations in the realization of the A series and their implications for the basic analysis. Section 6 summarizes the paper and concludes. In the Appendix we document the

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allomorphy found in the B series when appended directly to the verb as well as when combined with an A series subject marker.

2 Possessed Nouns

For the most part, Kaqchikel roots begin and end with at most one consonant. Exceptions to this generalization include roots ending in a glottal stop plus consonant (k'o'x 'corn liquor', qo'ch 'crow') and, less commonly, roots beginning with a coronal fricative plus stop (xkoya' tomato', ski't 'lizard sp.'). The dialect described in Matzar (1997) has the following paradigms for possessed nouns with the A-series of prefixes to mark the possessor. The prefixes have different surface forms depending on whether the following stem begins with a consonant or a vowel.[1]

(1)	citation	chom	ixim
	'my N'	nu-chom	w-ixim
	'your sg. N'	a-chom	aw-ixim
	'his N'	ru-chom	r-ixim
	'our N'	qa-chom	q-ixim
	'your pl. N'	i-chom	iw-ixim
	'their N'	ki-chom	k-ixim
	gloss	'shrimp'	'corn'

If the preconsonantal form of the prefix is analyzed as revealing the underlying representation, then the prevocalic form contains a /V-V/ sequence in the input. Putting aside the 1 sg., the prevocalic alternants consist of the consonant from the CV- form or a Vw- form for the prefixes that consist of a single vowel: CV≈C and V≈Vw. The truncation of the prefixal vowel and the insertion of a [w] glide can be subsumed under cross-linguistically common responses to hiatus. In a review of hiatus repairs, Casali (2011) finds that glide epenthesis is a common type. The glide is often homorganic with an adjacent vowel (Basque). But cases of fixed glides (palatal Washo or labial Chamicuro) also occur. Vowel truncation is an equally common hiatus resolution. Casali (2011) observes that it is normally the first vowel that is elided. This is particularly true at the prefix-stem boundary and is motivated by the importance of the stem-initial segment in lexical access.

Within the OT framework of competing and violable constraints (Prince and Smolensky 2004), hiatus has been analyzed in terms of either a constraint *V.V penalizing a sequence of two successive heterosyllabic vowels or a more general Onset constraint requiring a syllable to have a nonvocalic [+consonantal] onset. Under *V.V the repairs are restricted to the hiatus context. A word-initial vowel is treated separately; it may or may not invoke the same repair. An analysis appealing to Onset uses a more general constraint and suggests (though does not require) that the same repair occur for V.V as well as initial V. In Kaqchikel all words transcribed with an initial vowel begin phonetically with a glottal stop. The repairs providing the onset with a consonant are thus different: [w] in the case of V.V and [ʔ] in the case of #V. We shall therefore assume that the *V.V hiatus constraint motivates the changes in the prefixes of (1). The CV- truncation alternations arise from ranking the faithfulness constraint Max-V, which

[1]Our transcriptions follow the native orthography. Most letters have their customary IPA values except that x = [ʃ], j = [χ], and ch = [tʃ]. Ejectives are marked with the apostrophe as is the glottal stop.

penalizes deletion of a vowel, below the markedness constraint *V.V. The tableau in (2) shows how the output form [qixim] ‘our corn’ is derived from the input /qa-ixim/.

(2) *V.V » Max-V

/qa-ixim/	*V.V	Max-V
> qixim		*
qa.ixim	*!	

To account for the deletion of the first vowel instead of the second, we invoke positional faithfulness to the root dominating general input-output faithfulness.

(3) Max-V-root » Max-V

/qa-ixim/	Max-V-root	Max-V
> qixim		*
qaxim	*!	

When the prefix consists of a single vowel then the repair is insertion of [w]. The faithfulness constraint Dep-C, which prohibits epenthesis of a consonantal (nonsyllabic) segment, must be ranked below *V.V. The tableau in (4) shows how [awixim] ‘your corn’ is derived from /a-ixim/.

(4) *V.V » Dep-C

/a-ixim/	*V.V	Dep-C
> awixim		*
a.ixim	*!	

The analysis now contains two alternative repairs for a *V.V hiatus violation: truncation of the first vowel and epenthesis of a glide. We must ensure that glide epenthesis does not operate in CV prefixes. This is achieved if Dep-C dominates Max-V, as shown in (5).

(5) Dep-C » Max-V

/qa-ixim/	*V.V	Dep-C	Max-V
>qixim			*
qawixim		*!	
qa.ixim	*!		

But if Dep-C dominates Max-V the analysis chooses *[ixim] from /a-ixim/ instead of [awixim].

(6) Dep-C » Max-V

/a-ixim/	*V.V	Dep-C	Max-V
awixim		*!	

> ixim			*
a.ixim	*!		

The solution to this ranking paradox is to invoke the constraint Realize Morpheme (Kurisu 2001), which penalizes a morpheme with null phonological exponence in the output. RM will block the derivation in which the V- prefixes are truncated. If Realize Morpheme (RM) is ranked above Dep-C, it will correctly eliminate the truncating /a-ixim/ > [ixim] mapping.

(7) Realize Morpheme » Dep-C

/a-ixim/	RM	Dep-C
>awixim		*
ixim	*!	

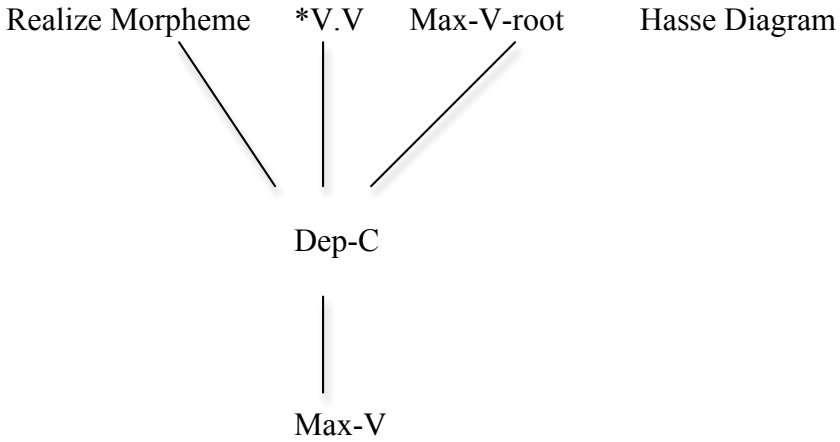
The analysis now says that the preferred response to a [V.V] violation is to delete the first vowel. But just in case the first vowel is the sole exponent of a morpheme, then the deletion candidate is excluded by Realize Morpheme. An alternative way to satisfy RM in the V-V cases would be to delete the root vowel, so that input /a-ixim/ maps to [axim]. Kaqchikel does not follow this option. To prevent it Max-V-root must dominate Dep-C. The tableau in (8) illustrates.

(8) Max-V-root » Dep-C

/a-ixim/	Max-V-root	Dep-C
>awixim		*
axim	*!	

The rankings postulated in our analysis are summarized in (9).

(9) *V.V » Max-V chooses qixim over qaixim
Dep-C » Max-V chooses qixim over qawixim
Max-V-root » Max-V chooses qixim over qaxim
Max-V-root » Dep-C chooses awixim over axim
Realize-Morpheme » Dep-C chooses awixim over ixim



3 Transitive Verbs

Basically the same array of alternations occurs when the A-series prefixes appear as subject markers on the verb (with some complications detailed below). The verbal morphology in Kaqchikel consists of an initial prefix marking tense-aspect followed by an object prefix, which in turn is followed by the transitive subject prefix and the verbal root [Tense-Obj-Subj-Root]. Verbal roots can begin with a consonant or a vowel. The latter give rise to underlying V.V hiatus structures. The paradigms in (10) illustrate the realizations of the transitive subject morphemes in the past tense with a 3 sg. object, which is 0. They have the form 'X Verb-ed him'.

(10)

1 sg.	x-in-to'	x-inw-ïl
2 sg.	x-a-to'	x-aw-ïl
3 sg.	x-u-to'	x-r-ïl
1 pl.	x-qa-to'	x-q-ïl
2 pl.	x-i-to'	x-iw-ïl
3 pl.	x-ki-to'	x-k-ïl
	'help'	'find'

The CV- prefixes qa- and ki- delete their vowels before a vowel-initial stem such as -ïl 'find' and the second person prefixes a- and i- insert the w glide in the same context. The analysis developed for the possessed nouns in the previous section thus directly extends to these forms.

There are two cases where the subject prefix takes a different form in the verbal inflection compared to the nominal. First, 1sg. nu- appears as nw- in the prevocalic verbal context ([x-inw-ïl]) where it triggers the epenthesis of [i]; but in nouns there is truncation of n before a vowel-initial stem (/nu-ixim/ > w-ixim). Second, in the 3 sg. the subject prefix ru- appears as u- when the verb root begins with a consonant: cf. /x-0-ru-to'/ > [x-u-to'] but /x-0-ru-ïl/ > [x-r-ïl].

We consider the 3 sg. ru- ≈ u- alternation first. It appears that ru- loses its consonant after a consonant. But this only occurs in the verb when the subject is preceded by the zero prefix marking the 3 sg. object, which in turn is preceded by the tense-marking prefixes. Compare [x-oj-ru-to'] 'he helped us'. Other CV subject prefixes do not lose their consonant: cf. 1 pl. [x-qa-to']. To account for the u- realization of ru- we postulate the constraint *#Cr banning a word-initial consonant cluster with r. The repair is deletion and so requires *#Cr to dominate Max-C.

(11) *#Cr » Max-C

/x-0-ru-to'/	*#Cr	Max-C
> xuto'		*
xruto'	*!	

If RM dominates *#Cr then deletion of the initial tense marking consonant in the verb is barred.

(12) Realize Morpheme » *#Cr

/x-0-ru-to'/	RM	*#Cr
> xuto'		
ruto'	*!	

This ranking also prohibits deletion of r in the hiatus context of vowel-initial stems.

(13) Realize Morpheme » *#Cr

/x-0-ru-ïl/	RM	*#Cr
> xrïl		*
rïl	*!	

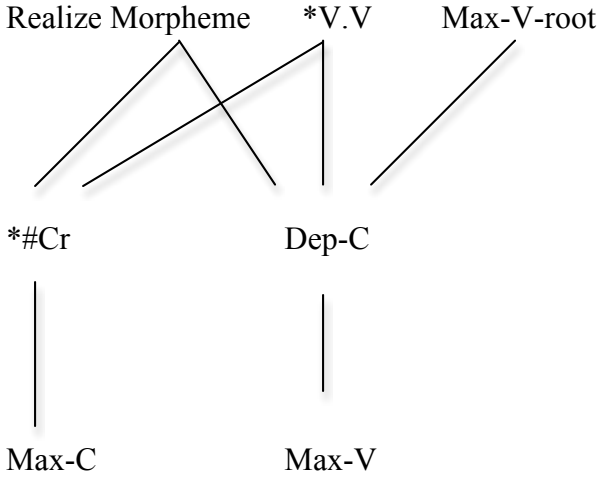
Finally, in the input-output mapping of /x-0-ru-ïl/ there are two conflicting constraint violations. The initial cluster violates *#Cr and the vowel sequence violates *V.V. RM blocks the [x-ïl] and [rïl] candidates that satisfy both markedness constraints. But in resolving the conflict between the two, *V.V must dominate *#Cr to ensure that truncation of the vowel takes precedence over truncation of the consonant cluster.

(14) *V.V » *#Cr

/x-0-ru-ïl/	*V.V	*#Cr
> xrïl		*
xu.ïl	*!	

(15) summarizes the rankings introduced in this section and also shows the expanded constraint hierarchy.

(15) *#Cr » Max-C
Realize Morpheme » *#Cr
*V.V » *#Cr



4 Syncope

There is one more reflex of the Realize Morpheme constraint in Kaqchikel inflection. This arises from the interaction with another alternation. In the speech of our Kaqchikel consultant the 1 sg. prefix nu- and the 3 sg. ru- optionally delete their vowels so that /nu-chom/ and /ru-chom/ may

be realized as [n-chom] and [r-chom]. This suggests a syncope constraint barring the "weak" (unstressed) vowel u in an open syllable: *u.[2] The ranking of these two constraints is not fixed. When *u. dominates Max-V (markedness > faithfulness), deletion occurs. When Max-V dominates *u. (faithfulness > markedness), then deletion is blocked.

(16) *u. ≈ Max-V

/ru-chom/	*u.	Max-V
> rchom		*
ruchom	*!	
/ruchom/	Max-V	*u.
> ruchom		*
rchom	*!	

But in the verbal inflection /x-0-ru-to'/ can only be realized as [xuto']. Other alternatives such as [xto'] and [xirto'] are unacceptable. Realize Morpheme blocks the /x-0-ru-to'/ > [xto'] mapping if it dominates *u.

(17) Realize Morpheme » *u.

/x-0-ru-to'/	RM	*u.
> xuto'		*
xto'	*!	

Syncope in the nominal forms is permitted since there is no competition with the constraint *#Cr compelling deletion of one of the consonants.

(18)

/ru-chom/	RM	*u.
> rchom		
ruchom		*!

Now we consider the 1 sg. prefix nu-. It has the most complex realization among the A-series prefixes and is summarized in (19).

(19)

	preconsonantal	prevocalic
noun	nu- ≈ n-	w-
verb	in-	inw-
noun	nu-chom ≈ n-chom	w-ixim
verb	x-in-to'	x-inw-ïl

[2] According to Majzul et al. (2000:45) the process has been extended to 3 pl. ki- in some dialects including Patzún. Our consultant did not exhibit this extension in her speech.

Before a vowel-initial stem the /u/ devocalizes to [w]. In the verb this gives rise to a CCC cluster, which is broken by an epenthetic [i]: /x-nu-ïl/ > [xinwïl]. In the noun the nw- cluster simplifies to [w]: /nu-ixim/ > [wixim]. Before a consonant-initial stem the u syncopates: /nu-chom/ > [nchom]. In the verb the resultant CCC cluster is broken by the epenthetic vowel: /x-nu-to'/ > [xinto']. An alternative analysis in which the [w] in nw- is treated as epenthetic and hence parallel to the glide appearing with other CV- prefixes is certainly possible; but it introduces opacity into the analysis (/nu-ixim/ > nuwixim > nwixim, eventually [wixim]) and so would require a more elaborated system of constraints along the lines of McCarthy (2007), which space limitations prevent us from exploring here.

The syncope motivating constraint *u. accounts for the deletion of the vowel in nu-. To account for the insertion of i, we postulate a constraint against three successive consonants *CCC. The syncope followed by epenthesis is reminiscent of colloquial Arabic dialects such as Palestinian, where we find alternations liked tí-ktib 'you write' but tí-kitb -u 'you pl. write' (Brame 1974).

(20) *CCC » Dep-V

/x-0-nu-to'/	*CCC	Dep-V
> xinto'		*
xnto'	*!	

In nouns the syncopated nu- is realized without epenthesis: [nu-chom], [n-chom], *[inchom]. Since initial consonant clusters are readily created when a CV- transitive subject prefix combines with a tense-aspect prefix (e.g. [x-ki-to'] 'they helped him'), it is triconsonantal clusters that are avoided in Kaqchikel rather than initial biconsonantal clusters.[3]

When 1 sg. nu- appears in hiatus, its vowel devocalizes to [w]. Since 3 sg. ru- does not devocalize we require an indexed constraint tied to the 1 sg. prefix Max-V/1sg. that is ranked above Ident-[syll]. This ranking blocks the deletion repair and allows the vowel of nu- to appear as a glide. For other prefixes such as ru- the lexically indexed constraint is not applicable and high ranking Ident-[syll] penalizes devocalization before the general Max-V assesses its penalty.

(21) Max-V/1sg. » Ident-[syll] » Max-V

/x-0-nu-ïl/	*V.V	Max-V/1sg.	Ident-[syll]	Max-V
> xinwïl			*	
xnu.ïl	*!			
xnïl		*!		
/x-0-ru-ïl/				
>xrïl				*
xiru.ïl	*!			
xirwïl			*!	

Finally, in order to derive the nominal [w-ixim] in place of the expected [nw-ixim] a constraint banning an initial #nw cluster must be posited. The repair deletes the external consonant, the furthest one from the syllable nucleus, the one with the poorest cues.

[3] Epenthesis is extended to initial biconsonantal clusters in some Kaqchikel dialects so that Patzún n-qa-tzijoj 'we count it' is realized as niqatzijoj (Majzul 2000: 50).

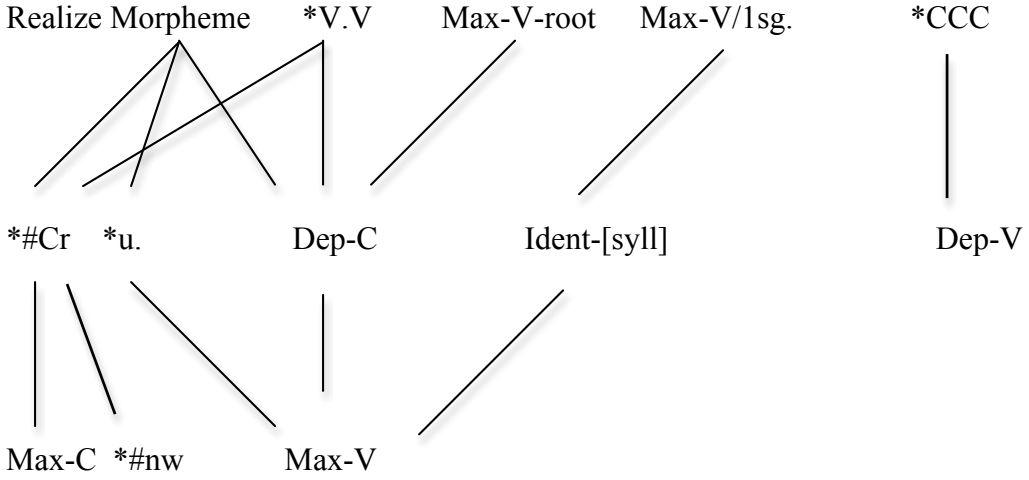
(22)

/nu-ixim/	*#nw	cues
> wixim		
nwixim	*!	
nixim		*!

(23) summarizes the constraint rankings motivated in this section along with the complete Hasse diagram.

(23)

*u » Max-V	chooses [rchom] over [ruchom]
*CCC » Dep-V	chooses [xinto'] over [xnto']
Max-V/1sg. » Ident-[syll]	chooses [xinwïl] over [xnïl]
Ident-[syll] » Max-V	chooses [xrïl] over [xirwïl]



An alternative approach to the prefixal alternations we have considered in this paper would be to list the preconsonantal and prevocalic morpheme alternants as alternative input forms and invoke syllable structure constraints banning hiatus and coda consonants to choose the appropriate variant: /qa- ≈ q-/ and /a- ≈ aw-/. This alternative analysis is motivated by a concern that the Kaqchikel alternations lack generality and hence could not be easily learned. The approach adopted here can be defended as follows. First, as Ryan Bennett observes, almost all Kaqchikel roots and suffixes end in a consonant and so it is not possible to find V-V hiatal contexts after the stem. Thus, while additional evidence for the alternation outside of the prefixal inflection is not available, there is no evidence contradicting it. Second, while the V≈0 alternation is of limited type frequency, it has very high token frequency, being found whenever transitive verbs are inflected. Third, the textbook alternations of [ɨ]≈0 in the English present and past tenses (comput-ed, kiss-es) motivating epenthesis are similarly restricted to these inflectional contexts (see Bakovic 2005 for a recent analysis). Finally, the glide epenthesis has been extended in some dialects (see below). This extension can be understood in terms of constraint reranking/rule reordering. It is less clear how it would be explained if the alternants are simply listed. The analysis proposed in this paper assumes that roots are protected from alternation with 0 by undominated root faithfulness, a cross-linguistically common state of affairs.

5 Variation

Majzul et al. (2000) mention two dialectal variants in the nominal and verbal inflection that should be discussed. They are shown in (24). Both involve generalizing the preconsonantal (base-form) prefixal alternants to the prevocalic hiatus context by extending the epenthesis repair and curtailing vowel truncation. They differ in the choice of the hiatus breaker. For nouns it is predominantly the glottal stop while for verbs it is the labial glide.

(24)

citation	chom	ixim	ixim
'my N'	nu-chom	w-ixim	nu'ixim
'your sg. N'	a-chom	aw-ixim	awixim
'his N'	ru-chom	r-ixim	ru'ixim
'our N'	qa-chom	q-ixim	qa'ixim
'your pl.'	i-chom	iw-ixim	iwixim
'their N'	ki-chom	k-ixim	ki'ixim
gloss	'shrimp'	'corn'	dialectal variant
1 sg.	x-in-to'	x-inw-ïl	xinwïl
2 sg.	x-a-to'	x-aw-ïl	xawïl
3 sg.	x-u-to'	x-r-ïl	xurïl
1 pl.	x-qa-to'	x-q-ïl	xqawïl
2 pl.	x-i-to'	x-iw-ïl	xiwïl
3 pl.	x-ki-to'	x-k-ïl	xkiwïl
	'help'	'find'	dialectal variant

We could characterize the dialectal difference in terms of constraint reranking: the variant dialects reverse the Dep-C » Max-V truncation ranking to Max-V » Dep-C, broadening the scope of glide epenthesis.

(25) Max-V » Dep-C

/ x-qa-ïl/	*V.V	Max-V	Dep-C
> xqawïl			*
xqaïl	*!		
xqïl		*!	

But radical changes like this are more plausibly explained by the intervention of a third factor that plays a role in language acquisition (assuming that such analogical changes are the product of first language acquisition, as proposed originally in the generative framework by Kiparsky 1971 in the context of the Abstractness debate). The key observation is that in the variant (and presumably innovating) dialects, the surface realization of the words with underlying vowel-initial stems have the same left-edge syllable as the consonant-initial ones. It is possible that the learner imposes this requirement as a way of minimizing variation between parallel cells across morphological paradigms, i.e. words that have the same INFL material.[4]

[4] See Ito and Mester (2004) and Kenstowicz and Sohn (2007) for other examples of such inter-paradigm uniformity.

(26) OO-Ident-Infl: The morphemes composing the INFL node have uniform exponence.

As long as this constraint ranks above Max-V, it will have the same effect as Max-V » Dep-C in eliminating the truncating solution to hiatus.

(27)

/ x-qa-ïl/	OOII	*V.V	Dep-C	Max-V
> xqawïl			*	
xqaïl		*!		
xqïl	*!			*
cf. xqa.to’				

In the dialectal variant for nouns in (25) the hiatus breaker is in general the glottal stop rather than the glide w. We see this as a reflex of another Output-Output faithfulness constraint--to the citation form of the noun stem. Recall that all underlying vowel-initial words begin with a phonetic glottal stop. This constraint will not be active in the verbal inflection because the verb stem does not occur as a bare form and must be inflected with tense and agreement prefixes. This noun-verb asymmetry parallels a similar disparity in Korean, where a process of cluster simplification affecting the bare form of a noun has been optionally extended through the inflectional paradigm so that /kaps/ ‘price’ inflects as [kap], [kaps-i], [kaps-ɨl] in variation with [kap], [kap-i], [kap-ɨl]. The process does not apply in verbs since their stem never occurs in isolation and must always be accompanied by inflectional suffixes that shield the stem from the word edge (Kenstowicz 1997).

(28) OO-Max-C: penalize a word whose stem lacks a consonant that is present in the output of the Base (citation) form.

/qa-ixim/	OO-Max-C	*V.V	Max-V	Dep-C
> qaʔixim				*
qa.ixim	*!	*		
qixim	*!		*	
qawixim	*!			*
Base ʔixim				

This analysis predicts that the second person singular and plural forms with the V-prefixes should also have a glottal stop. But they take the glide epenthesis option instead: /a-ixim/ is realized as [ʔawixim]. We exclude this incorrect outcome by invoking a constraint against successive glottal stop onsets: *ʔVʔ.

(29) *ʔVʔ » OO-Max-C

/a-ixim/	*ʔVʔ	OO-Max-C
> ʔawixim		*
ʔaʔixim	*!	
Base ʔixim		

6 Summary and Conclusion

This paper has proposed an OT analysis of the complex alternations exhibited by the A-series (ergative) prefixes in Kaqchikel. In the speech of our consultant the hiatus resulting from juxtaposing the CV- prefixes with vowel-initial stems is repaired primarily by vowel truncation. But truncation is blocked in V- prefixes by the constraint Realize Morpheme, which penalizes zero exponence for a morpheme. The alternative repair that steps in is epenthesis of the glide w. Our speaker optionally drops the vowel u from CV- prefixes. When a CCC cluster results, it is repaired by epenthesis of i. Some Kaqchikel dialects have curtailed vowel truncation and expanded the scope of glide epenthesis, resulting in a more uniform paradigmatic realization of the prefix as well as the stem. Finally, while the Realize Morpheme constraint has been invoked to motivate the docking of floating features, there are few if any cases in the OT literature where it has been argued to blocks process. According to the analysis proposed here, Kaqchikel fills this typological gap.[5]

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[5] Another example is furnished by Yoruba (Orie and Pulleyblank 2002), where the vowel of a CV verb truncates before the vowel of a following polysyllabic word to avoid hiatus: rà 'buy', ɔ̀gɛ̀dɛ̀ 'banana', but r- ɔ̀gɛ̀dɛ̀. In the standard dialect all verbs are of shape CV and so the surviving onset consonant satisfies Realize Morpheme. But in the Ondo dialect r has been lost, creating verbs consisting of a single vowel (Olanike-Ola Orie, p.c). With these verbs truncation is suspended: à acɔ 'buy cloth' (cf. Standard Yoruba /rà asɔ/ > r-asɔ) and í-oghó 'see money' (cf. Standard Yoruba rí 'see') but ní 'have', àbúò 'younger sibling', l-àbúò 'have younger sibling'.

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Appendix

We provide paradigms illustrating the realization of the pronominal prefixes in intransitive verbs (B series) and then in transitive verbs, which show the realization of both series in succession. The verbs are cited with the perfect tense prefix x-. Both a consonant-initial and a vowel-initial verb are provided. The 3 sg. in the B series is zero. All other forms in the B series are vowel-initial. When they occur before a vowel-initial stem they take the shape VC to avoid hiatus. The 1 and 2 singular forms show allomorphic variation between prevocalic VC and preconsonantal V. The 3 pl. e- takes a glottal stop before a vocalic verb stem that is probably best treated as phonetic comparable to word-initial position where vowel-initial words begin with a glottal stop.

B-series Intransitive Verb

x-i-b'e	I went	x-in-oq'	I cried
x-a-b'e	you went	x-at-oq'	you cried
x-b'e	he went	x-oq'	he cried
x-oj-b'e	we went	x-oj-oq'	we cried
x-ix-b'e	you pl. went	x-ix-oq'	you pl. cried
x-e-b'e	they went	x-e'-oq'	they cried

Below are the paradigms for a consonant-initial verb stem /to'/ 'help' and a vowel-initial stem /axaj/ 'hear' showing all possible combinations of the direct object B series plus subject marking A series. There are several points of interest. First, the forms with a 3 pl. object prefix and 1 sg. subject x-e-n-to' 'I helped them' and x-e-nw-axaj 'I heard them' are consistent with treating the [i] of the 1 sg. subject marker seen in x-in-to' 'I helped him' and x-inw-axaj 'I heard him' as epenthetic vowels breaking a CCC cluster. Second, the 1 sg. and 2 sg. B series markers in- and at- have i- and a- allomorphs before a consonant. The plural suffixes oj-, -ix- and e- have a

constant shape, assuming that the glottal stop of prevocalic e'- is inserted in the phonetics. Third, the 1 sg. in- and 2 sg. at- B prefixes take their codaless alternants before the verb (when intransitive subjects). Before the A series subject markers they take their full form except when the subject is 3 sg.: cf. x-in-ki-to' 'they helped me' vs. x-i-r-to' 'he helped me' and x-at-ki-to' 'they helped you sg.' vs. x-a-r-to' 'he helped you sg.'.

Transitive Verb with B-series Object plus A-series Subject

x-at-in-to'	I helped you	x-at-inw-axaj	I heard you
x-in-to'	I helped him	x-inw-axaj	I heard him
x-ix-in-to'	I helped you pl.	x-ix-inw-axaj	I heard you pl.
x-e-n-to'	I helped them	x-e-nw-axaj	I heard them
x-in-a-to'	you helped me	x-in-aw-axaj	you heard me
x-a-to'	you helped him	x-aw-axaj	you heard him
x-oj-a-to'	you helped us	x-oj-aw-axaj	you heard us
x-e'-a-to'	you helped them	x-e'-aw-axaj	you heard them
x-i-r-to'	he helped me	x-i-r-axaj	he heard me
x-a-r-to'	he helped you	x-a-r-axaj	he heard you
x-u-to'	he helped him	x-r-axaj	he heard him
x-oj-r-to'	he helped us	x-oj-r-axaj	he heard us
x-ix-r-to'	he helped you pl.	x-ix-r-axaj	he heard you pl.
x-e-r-to'	he helped them	x-e-r-axaj	he heard them
x-at-qa-to'	we helped you	x-at-q-axaj	we heard you
x-qa-to'	we helped him	x-q-axaj	we heard him
x-ix-qa-to'	we helped you pl.	x-ix-q-axaj	we heard you pl.
x-e-qa-to'	we helped them	x-e-q-axaj	we heard them
x-in-i-to'	you pl. helped me	x-in-iw-axaj	you pl. heard me
x-i-to'	you pl. helped him	x-iw-axaj	you pl. heard him
x-oj-i-to'	you pl. helped us	x-oj-iw-axaj	you pl. heard us
x-e'-i-to'	you pl. helped them	x-e'-iw-axaj	you pl. heard them
x-in-ki-to'	they helped me	x-in-k-axaj	they heard me
x-at-ki-to'	they helped you	x-at-k-axaj	they heard you
x-ki-to'	they helped him	x-k-axaj	they heard him
x-oj-ki-to'	they helped us	x-oj-k-axaj	they heard us
x-ix-ki-to'	they helped you pl.	x-ix-k-axaj	they heard you pl.
x-e-ki-to'	they helped them	x-e-k-axaj	they heard them

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