

Prosodic constituency of verb-initial clauses in Ch'ol*

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Abstract: This paper assesses the prosodic predictions of two different accounts of verb-initial (V1) word order in Ch'ol (Mayan) on the basis of findings from a preliminary study of sentence-level prosody. On the right-side specifier account, i) subjects are generated in a specifier oriented to the right of its head (VOS) and ii) the object is post-posed to a position higher than the subject (VSO) (Aissen 1992; England 1991). On the XP(-remnant)-movement account, either i) a maximal projection containing the predicate raises to the left of the subject (VOS), or ii) the object leaves the predicate before predicate fronting ensues (VSO). Both of these accounts correctly predict that the verb and the object form a prosodic constituent in VOS clauses. In addition, the right-side specifier account predicts the existence of a strong prosodic boundary between the subject and the object in VSO, which is not borne out in the data.

Keywords: V1 languages, Mayan, Ch'ol, prosody constituency

1 Introduction

While the Mayan family is predominantly verb-initial (V1), individual Mayan languages display a preference for strict VSO or alternating VOS/VSO word orders (England 1991). For Ch'ol, a VOS/VSO language, the primary syntactic factor in the choice between VSO and VOS is the functional structure associated with the object: NP objects are found in VOS clauses, while DP objects surface in VSO contexts (Coon 2010). The two dominant syntactic accounts of V1 word order in Mayan languages—the right-side specifier account (Aissen 1992) and the VP-raising account (Coon 2010)—can both account for the distribution of NP vs. DP objects in Ch'ol.¹ However, these two accounts make different predictions with respect to prosodic constituency—especially for VSO clauses. The purpose of this paper is to bring prosodic evidence to bear on the problem of VOS/VSO alternations in Ch'ol.

This paper is organized as follows: Section 2 reviews VOS/VSO alternations in Ch'ol; Section 3 introduces the primary syntactic accounts of V1 order in Ch'ol

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¹See Clemens and Coon 2016 for a V⁰-raising account of Mayan V1 and a prosodic explanation for VOS/VSO alternations in Ch'ol (and see Clemens 2014 for related discussion). Although we do not address Clemens and Coon's proposal in this paper, the prosodic facts discussed here are consistent with that analysis.

and Mayan more generally, as well as the predictions that those accounts make for subsequent prosodic structure; Section 4 presents an investigation into the prosody of VSO and VOS clauses in Ch’ol; Section 5 concludes.

2 VOS and VSO in Ch’ol

Basic word order in Ch’ol is VOS (Coon to appear, Vázquez Álvarez 2002, 2011); examples are shown in (1):²

- (1) a. Tyi i-kuch-u [O si’] [S aj-Maria].
 PFV A3-carry-SS wood CLF-Maria
 ‘Maria carried wood. (Coon 2010:355)
- b. Tyi y-il-ä [O x’ixik] [S wiñik]
 PFV A3-see-TV woman man
 ‘The man saw the woman.’ (Vázquez Álvarez 2011:21)

As the above examples show, VOS is possible whether the object is animate (1b) or inanimate (1a) (inanimate subjects are dispreferred, regardless of word order). However, as discussed in detail in Coon (2010), VOS objects may not be full DPs. This is shown by the ungrammaticality of the sentences in (2):

- (2) a. *Tyi i-kuch-u [O ili si’] [S aj-Maria].
 PFV A3-carry-TV DEM wood CLF-Maria
 Intended: ‘Maria carried that wood.’ (Coon 2010:355)
- b. *Tyi y-il-ä [O jiñi x’ixik] [S wiñik].
 PFV A3-see-TV DET woman man
 Intended: ‘The man saw the woman.’

If both arguments are post-verbal DPs, VSO order is preferred (3):

- (3) a. Tyi i-kuch-u [S aj-Maria] [O ili si’].
 PFV A3-carry-TV CLF-Maria DEM wood
 ‘Maria carried that wood.’
- b. Tyi y-il-ä [S aj-Pedro] [O jiñi wiñik].
 PFV A3-see-TV CLF-Pedro DET man
 ‘Pedro saw the man.’

Note that in (3b), the immediately post-verbal argument is a proper name introduced by a classifier—i.e., a full DP. The VOS reading of this sentence is thus

²Abbreviations used in glosses are as follows: A – “Set A” (ergative, possessive); B – “Set B” (absolutive); CLF – classifier; DEM – demonstrative; DET – determiner; PFV – perfective; PREP – preposition; TV – transitive verb.

ruled out by the restriction against DP objects in VOS. In other words, (3b) cannot be interpreted to mean ‘the man saw Pedro.’

Next, the ability of the object in VOS clauses to be modified (4), shows that VOS clauses are not instances of head incorporation:

- (4) Tyi i-māñ-ä pejtyelel tyumuty jiñi alob.
 PFV A3-buy-TV all egg DET boy
 ‘The boy bought all the eggs.’ (Coon 2010: 360)

Finally, temporal adverbs can intervene between the verb and a DP object, as in (5a), but they cannot intervene between the verb and an NP object (5b). The placement of these adverbs is consistent with the fact that the verb and object form a surface constituent in VOS clauses.

- (5) Location of adverbs
- a. Tyi k-wuts’-u abi ili pisil.
 PFV A1-carry-TV yesterday DEM clothes
 ‘I washed these clothes yesterday.’
- b. *Tyi k-wuts’-u abi pisil.
 PFV A1-carry-TV yesterday clothes
 Intended: ‘I washed clothes yesterday.’
- c. Tyi k-wuts’-u pisil abi.
 PFV A1-carry-TV clothes yesterday
 ‘I washed clothes yesterday.’ (Coon 2010: 367)

Based on the facts presented in this section, the desiderata of any syntactic account of Ch’ol word order should include an explanation for (i) the correlation between word order and the functional structure associated with the object and (ii) the fact that the verb and the object in VOS structures behave like a unique constituent in a way that the verb and the subject in VSO structures do not.

3 Syntactic accounts

The primary (possibly only) formal accounts of V1 order in Mayan are found in Aissen (1992) and Coon (2010). The first approach, which we call the right-side specifier account, has been adopted by most researchers working on Mayan languages. This account orients the subject to the right of the predicate; thus, VOS order arises when all of the major sentential constituents surface *in situ*. An alternative, movement-based account comes from Coon (2010), who argues that V1 is derived by fronting a maximal projection containing the predicate. The right-side specifier and XP(-remnant)-raising accounts will each be discussed in this section, alongside their prosodic predictions.

3.1 Right-side specifier account

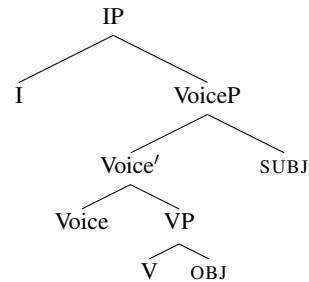
The standard approach to Mayan V1 comes from Aissen (1992), who argues that the relative order of the head and the specifier of a given maximal projection is parameterized in Mayan languages: the specifiers of functional projections are oriented to the left of their heads, while the specifiers of lexical projections are oriented to the right of their heads. This parameter captures the fact that topics, foci, and *wh*-words appear in a preverbal position.

On this account, non-focused, non-topicalized subjects are located in the highest projection of the verbal complex. Since this base-generation position is a lexical category, it projects its specifier to the right. Thus, Aissen (1992) base-generates VOS by placing the subject in a right-side specifier, as in (6a).

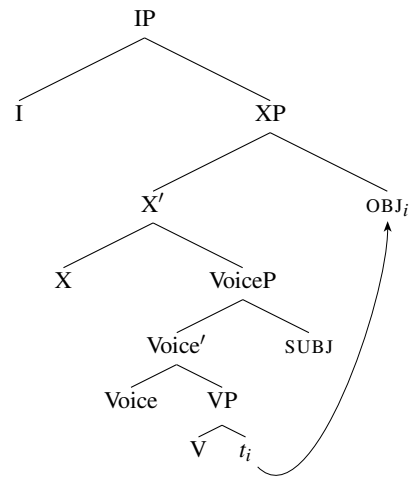
Aissen's (1992) account focuses on the position of preverbal arguments. Her approach is nonetheless compatible with a VSO derivation which takes VSO objects in VOS/VSO-alternating languages to be postposed from an underlying VOS syntax (see e.g. England 1991 and references there). Thus, on the right-side specifier account, VSO order can be derived by post-posing the object to the right of the subject, as in (6b).

(6) Right-side specifier

a. VOS



b. VSO

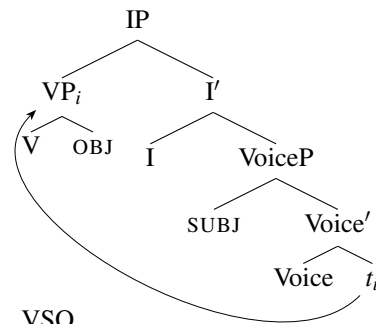


3.2 XP(-remnant)-raising account

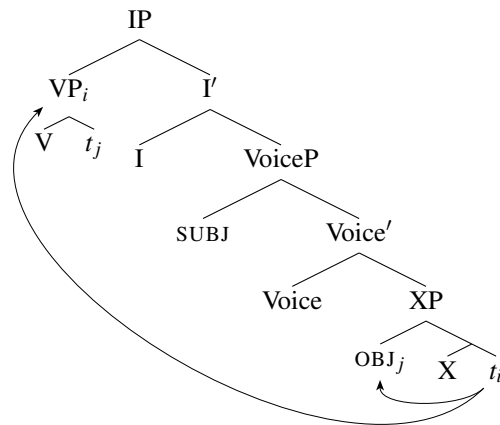
An alternative account was developed by Coon (2010), who argues that VOS in Ch'ol is derived by fronting an XP containing the verb and its object above the subject (see also Massam's (2001) account of pseudo noun incorporation in Niuean). On this account, bare NP objects remain VP-internal, producing VOS word order, as simplified in (7a). In contrast, DP objects evacuate the VP before the predicate moves, as in (7b):

(7) XP(-remnant) raising

a. VOS



b. VSO



3.3 Prosodic predictions

Assuming that prosodic constituents correspond to syntactic constituents in most cases (see Itô & Mester 2012; Ladd 2008; Wagner 2005, et seq.; Selkirk 2011; and sources cited therein), both the right-side specifier account and the XP-raising account predict that the verb and the object should form a prosodic constituent in VOS contexts. In other words, if either of these accounts holds, we should expect to find evidence for the existence of a prosodic constituent corresponding to VP in (6a) and (7a).

A second prediction pertains to the prosodic characteristics associated with the object in VSO contexts. On the right-side specifier account of Mayan V1, the object moves to the right of the subject via extraposition. We would expect this sort of movement to affect the prosody of VSO clauses, such that a strong boundary—perhaps even an intonational phrase boundary (*t*-phrase)—would separate the object from the subject in VSO clauses (for more on the prosody of DP extraposition, see e.g., Leonarduzzi and Herment 2013 and Kalbertodt et al. 2015). The next section presents the results of an investigation probing the outcomes of these two predictions in the Mayan language Ch’ol.

4 The prosody of Ch’ol VOS/VSO alternations

This section introduces an initial investigation into the prosody of VOS and VSO clauses in Ch’ol. Of particular interest in the context of the current paper is prosodic evidence indicating whether i) the verb and the object form a prosodic constituent in VOS clauses and ii) the object is extraposed in VSO clauses.

In what follows, three acoustic cues to prosodic boundary marking are examined: pitch, duration, and the distribution of pauses. We begin by exploring intonational patterns, based on the understanding that H% tones commonly mark prosodic boundaries in Mayan languages (Bennett to appear). We look for corroborating evidence from duration because phrase-final lengthening is a common cue for the presence of a prosodic boundary cross-linguistically (Klatt 1976; Nespor and Vogel 1986). Finally, we consider the distribution of pauses, which are predicted to occur at prosodic junctures, and particularly at the boundaries of constituents that are relatively high in the prosodic hierarchy; thus, more pauses should occur at *t*-phrase boundaries than at \emptyset -phrase boundaries (Scott 1982; Wightman et al. 1992).

4.1 Methodology

In order to analyze the prosody of VOS and VSO in Ch’ol, a reading-based experiment was conducted. As most Ch’ol speakers are not comfortable reading in Ch’ol, the nature of the task used in this experiment restricted the number of available participants. Nevertheless, the use of a reading task was necessary, as transitive clauses with two overt arguments are uncommon in spontaneous Ch’ol speech.

The rarity of VOS and VSO sentences has been documented for a variety of Mayan languages (see England 1991 and references there), and is the result of two main factors. First, in most Mayan languages, core arguments may be dropped once they have been established in the discourse. For example, Vázquez Álvarez and Zavala (2013) found that in a corpus of 2496 naturally-produced Ch’ol utterances, only 41 of 657 transitive sentences had two overt arguments. Second, as noted above, topicalized and focused constituents are realized preverbally, so only a subset of clauses with two overt arguments can be expected to include two *postverbal* arguments. Nonetheless, Ch’ol speakers do produce (albeit infre-

quently) both VOS and VSO sentences.

Data for this study came from four native speakers of the Tila variety of Ch'ol: three women and one man between the ages of 20 and 40. Participants were instructed to read target sentences as naturally as possible and to repeat each example until they were satisfied that the version we recorded was natural-sounding.

Sentences with major disfluencies or significant ambient noise were not included in the analysis. Because the data were collected in the field, a relatively high number of examples were excluded, particularly due to ambient noise. We used Prosodylab Aligner (Gorman et al. 2011), a forced-alignment tool, to automatically annotate the sentences we recorded at the segmental level. We found that it was necessary to fine-tune the automatic alignment, so a group of undergraduate research assistants manually adjusted the automatic annotations. Finally, we obtained measurements for pitch and duration with scripts written for Praat (Boersma and Weenik 2013).

4.2 Materials

Experimental materials were normed by a native-Ch'ol-speaking linguist and were constructed in such a way as to highlight the influence of two variables on prosodic constituency: word order and nominal modification. Examples with and without nominal modifiers were included in order to determine whether prosodic constituency is affected by the size of the syntactic constituent, as found for Irish, another V1 language (Elfner 2012). Experimental materials included 11 items, for a total of 44 target sentences (2 x 2 x 11).

Adverbial material was placed in the final position of target sentences to avoid the prosodic confound of phrase-final effects on the second argument. In an attempt to control for unforeseen eurythmic effects, all head nouns and modifiers were bi- or trisyllabic. Finally, the target sentences were made sonorant-rich in order to facilitate F0 measurement.

Mayan phoneme inventories—which do not have a voiced stop series and exhibit devoicing in some contexts—do not lend themselves easily to this task. As such, some of the target sentences are unusual and depict uncommon occurrences. Example (8) below illustrates one item for each condition; where Condition 1 (C1) is a VSOX clause with nominal modification; Condition 2 (C2) is a VSOX clause without nominal modification; Condition 3 (C3) is a VOSX clause with nominal modification; and Condition 4 (C4) is a VOSX clause without nominal modification:

- (8) Example item; each condition (glosses simplified)
- a. Tyi ibä'nä ili jujp'embä ñeñe' jiñi chämeñ lukum tyi abälel.
PFV fear DEM fat baby DET dead snake PREP night
'That fat baby feared the dead snake at night.' C1
 - b. Tyi ibä'nä ili ñeñe' jiñi lukum tyi abälel.
PFV fear DEM baby DET snake PREP night
'That baby feared the snake at night.' C2

- c. Tyi ibä'ñä chämeñ lukum jiñi jujp'embä ñeñe' tyi abälel.
 PFV fear dead snake DET fat baby PREP night
 'The fat baby feared the dead snake at night.' **C3**
- d. Tyi ibä'ñä lukum jiñi ñeñe' tyi abälel.
 PFV fear snake DET baby PREP night
 'The baby feared the snake at night.' **C4**

4.3 Results

Ch'ol sentences are realized with a series of H pitch peaks, beginning on the final syllable of the anchoring word. H% tones reach their maximum F0 value on the same syllable, or in some cases, on the following syllable. After reaching the maximum value, F0 typically begins to fall on the same syllable. Figure 1 illustrates the distribution of H tones in a VSOX clause.³

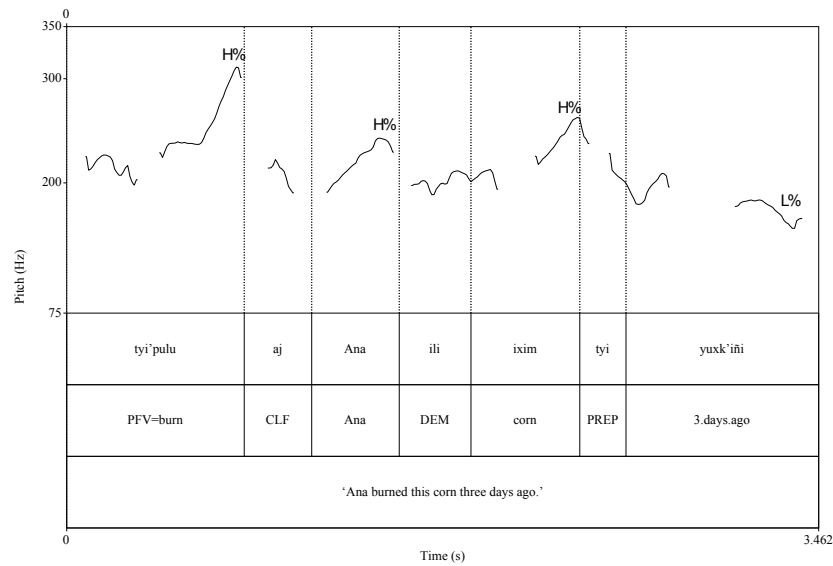


Figure 1: Example pitch contour of a VSOX clause.

H tones appear to be associated with the right edge of a constituent that is larger than the phonological word (not all phonological-*ws* have H% tones) and smaller than the clause (each clause has multiple H% tones). As such, we posit that H% is a boundary tone that marks the right edge of phonological phrases (ϕ -phrases). H% boundary tones also occur in utterance-final position, but L%

³The examples in Figures 1 and 2 represent *tyi* PREV as a clitic, because in these contexts, it is realized as such. In contrast, the glossed examples follow the Ch'ol orthographic convention of representing aspect markers as independent words.

boundary tones are more common in this position. L% boundary tones also appear clause-internally, preceding a pause.

4.3.1 Verb – object constituency

An interesting difference arises in the distribution of H% tones in VSO as compared to VOS clauses: the verb in VSO clauses is marked with a boundary tone, while in VOS clauses, there is no boundary tone on the verb. We take this difference to indicate that the verb and the object in VOS clauses form a unique prosodic constituent, while the verb and the subject in VSO clauses do not. Compare Figure 1 to Figure 2, which highlights this contrast.

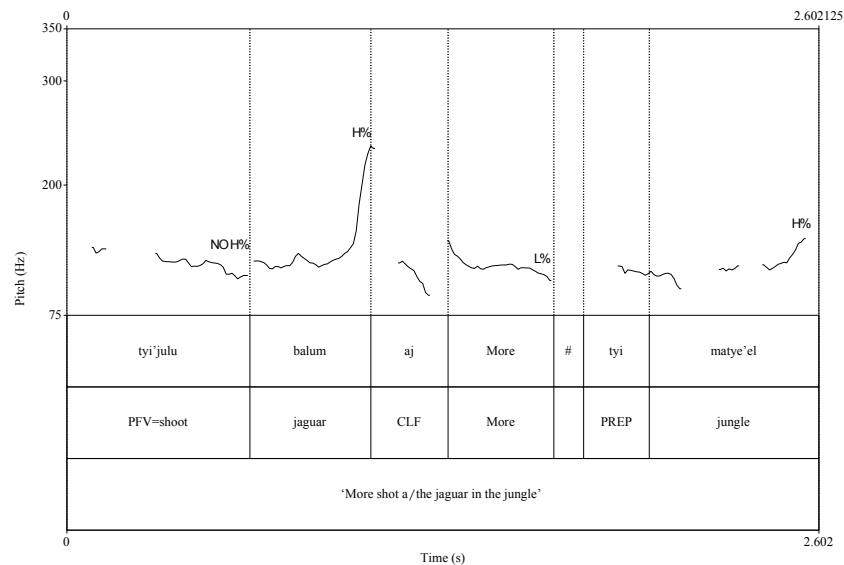


Figure 2: No H% on verb in VOS.

Relatedly, the pitch maximum associated with H tone that delimits the object from the subject in VOS clauses is demonstrably higher than the pitch maximum associated with the H delimiting the subject from the object in VSO clauses. Figure 3 shows a time-normalized pitch contour associated with the first argument in VSO as compared to VOS clauses, illustrating the fact that the H associated with the subject in VSO clauses is lower than the one associated with the object in VOS. This difference is likely to be caused by downdrift, where the pitch maximum associated with each subsequent H lowers over the course of the sentence. Downdrift is present in most of our example sentences, and it is generally most apparent between the first and second H.

The absence of downdrift on the H anchored to the object in VOS contexts is important, because it corroborates the finding that the verb and the object in VOS clauses are phrased together, while the verb and the subject in VSO clauses are

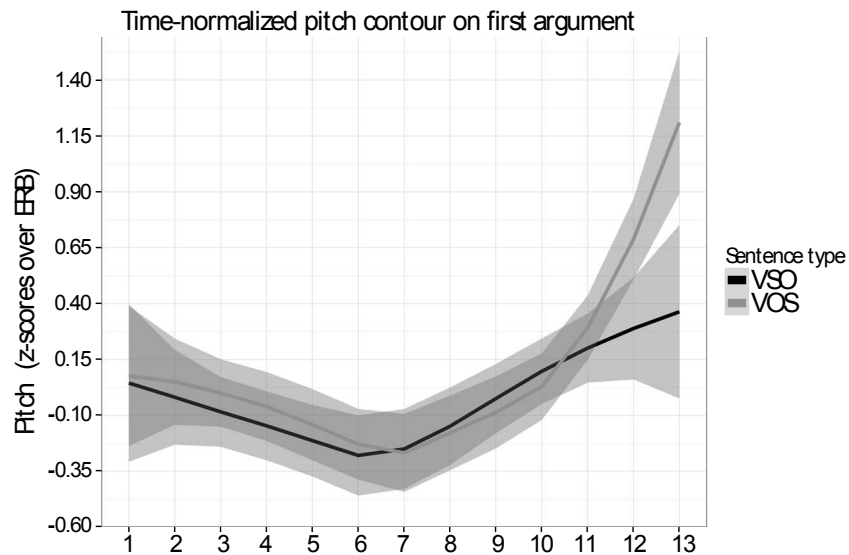


Figure 3: Comparing pitch maxima of first postverbal arguments.

phrased independently. The H associated with the object in VOS clauses marks the first φ -phrase boundary in a VOS clause, and so there is no downdrift, whereas the H associated with the subject in VSO clauses *has* undergone downdrift, because it marks the *second* φ -phrase boundary in a VSO clause.

With respect to the distribution of the H tone, the experimental results show no differences in the behavior of modified versus unmodified arguments. Adjectival modifiers do not bear H tones. Additional evidence suggesting that preverbal modifiers in Ch'ol form prosodic units with the noun they modify comes from Lesure and Clemens (to appear). Using the same data set, these authors find that word-final sonorants are realized with creaky voice word-finally. Because word-final sonorants are creakier at the ends of nouns than at the ends of adjectives that proceed them, Lesure and Clemens argue that creakiness is a measure of boundary strength in Ch'ol. The relative creakiness of sonorants at the ends of nominal modifiers, compared to the modifiers themselves, thus marks the difference between a word boundary and a φ -phrase boundary.

4.3.2 Objects in VSO clauses

If VSO objects are syntactically postposed, one might expect prosodic structure to reflect that syntactic reality in the form of a strong acoustic boundary between the subject and the object in VSO clauses. By hypothesis, speakers might be more likely to pause between the subject and object in VSO clauses (VS#O) than in VOS clauses (VO#S) if postposition has taken place.

Approximately 15% (25 of 170) of the example sentences in the Ch’ol experiment contained a pause lasting an average of 76 *ms* and ranging from 37-166 *ms*. Table 1 summarizes the distribution of pauses in the data set according to whether they occur preceding i) the first argument in the clause (the object in VOS; the subject in VSO), ii) the second argument in the clause (the subject in VOS; the object in VSO); or iii) a phrase-final adjunct.

Table 1 demonstrates that speakers are equally likely to pause before an object in VSO contexts as they are to pause before a subject in VOS contexts. Speakers are also just as likely to pause before an object in VSO contexts as they are to pause before the subject in VSO contexts. As such, there is no evidence from the distribution of pauses to support the postposing analysis of VSO word order.

Table 1: Number of pauses in different positions.

	_ARG1	_ARG2	_ADV
VxSxOX	3	4	0
VSOX	2	2	3
VxOxSX	0	3	4
VOSX	0	2	2

In addition, it is worth noting that speakers did not pause between the verb and the object in VOS clauses, which is consistent with the observation that the verb and the object in VOS clauses form a unique prosodic constituent. Likewise, speakers did not pause between nominal modifiers and the nouns they modify.

Turning to duration, one might expect that, if objects are postposed in VSO contexts, the prosodic constituent preceding the object might exhibit a greater degree of phrase-final lengthening due to the presence of a stronger prosodic boundary. In order to investigate this possibility, we measured the duration of the immediately postverbal argument in each condition. These results are summarized in Table 2.

Table 2: Duration of the immediately postverbal argument in *ms*.

	UNMODIFIED	MODIFIED
VOS	52	49
VSO	48	48

Table 2 shows that unmodified objects in VOS clauses are significantly longer than unmodified subjects in VSO clauses (Paired T-Test; $p < 0.005$). The difference in duration between the object in VOS clauses and the subject in VSO clauses reaches statistical significance, but the size of the effect is below the perceptibility threshold (Stevens 2000), suggesting that phrase-final lengthening is a mechanical

effect of prosodic planning (Myers and Hansen 2007), as opposed to a reliable cue of prosodic constituency. Furthermore, the importance of this finding is perhaps attenuated by the fact that no durational difference among modified postverbal arguments was observed. Despite these caveats, the facts presented here are the opposite of what the object postposing account predicts: there is more phrase-final lengthening before the subject in VOS contexts than there is before the object in VSO contexts.

Nonetheless, these results are somewhat mysterious: we might have expected both types of postverbal arguments to demonstrate an equal amount of phrase-final lengthening, because they are both located at the edge of a φ -phrase. All else being equal, it may be the case that phrase-final lengthening is affected by a boundary's location in an utterance, such that later boundaries are realized with less phrase-final lengthening than preceding boundaries. The fact that the object in VOS clauses is at the edge of an earlier φ -phrase boundary than the subject in VSO clauses may explain why the object in VOS clauses is longer than the subject in VSO clauses.

5 Conclusion

After investigating three acoustic cues to prosodic boundary-marking—pitch, duration and the distribution of pauses—we conclude that VSO and VOS clauses in Ch'ol are produced with the prosodic constituency schematized in 9:

- (9) Prosodic phrasing of VSO and VOS clauses
- a. $(V)_\varphi (S)_\varphi (O)_\varphi$
 - b. $(V O)_\varphi (S)_\varphi$

These findings are consistent with the VP-raising analysis of VSO/VOS alternations in Ch'ol, as well as the account developed in Clemens and Coon 2016. On the one hand, we have found evidence, primarily from the distribution of H% tones, that the verb and the object in VOS clauses form a unique prosodic constituent. This finding is consistent with both of the syntactic accounts considered. On the other hand, the data on phrase-final lengthening do not support a syntactic analysis where the object is postposed in VSO clauses.

Ch'ol is merely one type of VOS/VSO alternating language within the Mayan family. A variety of factors have been reported to influence the order of postverbal arguments, including specificity, definiteness, phonological weight, and animacy of arguments (Aissen 1992; England 1991). Future work should determine whether the verb and the object are always phrased together in VOS, whether or not the object is bare.

References

- Aissen, J. L. (1992). Topic and focus in Mayan. *Language*, 68:43–80.
- Bennett, R. (to appear). Mayan phonology. *Langage and Linguistics Compass*.
- Boersma, P. and Weenik, D. (2013). Praat: doing phonetics by computer [computer program]. Version 5.3.51. <http://www.praat.org/>.
- Clemens, L. E. (2014). *Prosodic noun incorporation and verb-initial syntax*. PhD thesis, Harvard University, Cambridge, MA.
- Clemens, L. E. and Coon, J. (2016). *Deriving mayan v1: A fresh look at ch'ol*. University at Albany.
- Coon, J. (2010). VOS as predicate fronting in Chol Mayan. *Lingua*, 120:345–378.
- Elfner, E. (2012). *Syntax-prosody interactions in Irish*. PhD thesis, University of Massachusetts Amherst.
- England, N. (1991). Changes in basic word order in Mayan languages. *International Journal of American Linguistics*, 57:446–486.
- Gorman, K., Howel, J., and Wagner, M. (2011). Prosodylab-aligner: A tool for forced alignment of laboratory speech. *Canadian Acoustics*, 39:192–193.
- Itô, J. and Mester, A. (2012). Prosodic subcategories in Japanese. *Lingua*.
- Kalbertodt, J., Primus, B., and Schumacher, P. B. (2015). Punctuation, prosody, and discourse: Afterthought vs. right dislocation. *Frontiers in Psychology*, 6:1803.
- Klatt, D. (1976). Linguistic uses of segmental duration in English: acoustic and perceptual evidence. *Journal of the Acoustical Society of America*, 59:1208–1221.
- Ladd, D. R. (2008). *Intonational Phonology*. Cambridge University Press, Cambridge, UK, 2nd edition.
- Leonarduzzi, L. and Herment, S. (2013). The limits between extrapositions and right-dislocation. *Cercles*, 29:46–66.
- Lesure, C. and Clemens, L. E. (to appear). Prosodic boundary marking in ch'ol: Acoustic indicators and their applications. In *Proceedings of the Conference on Indigenous Languages of Latin America – VII*.
- Myers, S. and Hansen, B. B. (2007). The origin of vowel length neutralization in final position: Evidence from Finnish speakers. *Natural Language and Linguistic Theory*, 25:157–193.
- Nespor, M. and Vogel, I. (1986). *Prosodic Phonology*. Dordrecht: Foris.
- Scott, D. (1982). Duration as a cue to the perception of a phrase boundary. *Journal of the Acoustical Society of America*, 71:996–1007.
- Selkirk, E. (2011). The syntax-phonology interface. In Goldsmith, J., Riggle, J., and Yu, A. C. L., editors, *The Handbook of Phonological Theory*, pages

435–484. Wiley-Blackwell, 2nd edition.

Stevens, K. N. (2000). *Acoustic Phonetics*. MIT Press.

Vázquez Álvarez, J. J. (2002). Morfología del verbo de la lengua chol de Tila Chiapas. M.A. thesis, CIESAS, México.

Vázquez Álvarez, J. J. (2011). *A Grammar of Chol, a Mayan language*. PhD thesis, The University of Texas at Austin.

Wagner, M. (2005). *Prosody and recursion*. PhD thesis, MIT.

Wightman, C., Shattuck-Hufnagel, S., Ostendorf, M., and Price, P. (1992). Segmental durations in the vicinity of prosodic boundaries. *Journal of the Acoustical Society of America*, 91:1707–1717.