Mobile Object Markers in Moro: The Role of Tone
Sharon Rose (UC San Diego) and Peter Jenks (UC Berkeley)

1. INTRODUCTION. The position of affixes within a word is correlated with a variety of different factors. On the one hand, morphosyntactic analyses relate affix position with syntactic derivation (Baker 1985), reflected in scope relationships (Rice 2000). In some languages, on the other hand, the positions of affixes are fixed relative to one another, sometimes violating scope relationships (Hyman 2003, Caballero 2010), and motivating the use of morphological templates or fixed order stipulations (Inkelas 1993, Hyman 2003, Good 2007). There are also a handful of cases in which phonological factors appear to impact affix or clitic position, typically driven by syllable structure (Fulmer 1991, Noyer 1994, Hargus & Tuttle 1997, Kim 2008) or stress (Caballero 2010).

In two cases in particular, Afar (Fulmer 1991, Rucart 2006) and Huave (Noyer 1994, Kim 2008, 2010), a small set of affixes may appear as either a prefix or a suffix depending on syllable structure and whether the stem begins with a consonant or vowel, cases which has been termed MOBILE AFFIXATION (Noyer 1994). For example, in San Francisco del Mar Huave, the completive affix /t/ is a suffix in (1a), but a prefix in (1b) (Kim 2008, 2010):

1a. [word] /t/ [word]
1b. [word] /t/ [word]

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Kim argues persuasively that the position of this and five other monoconsonantal affixes is determined by syllable structure. The affixes are prefixes if the stem begins with a vowel and ends in a consonant. Otherwise, they are suffixes. The analysis she offers depends on a conception of the phonology-morphology interface in which phonological constraints can outrank morphological constraints of affix placement, the P(honology) >> M(orphology) approach of McCarthy & Prince (1993). Noyer (1994) proposes a similar, but less detailed, analysis for San Mateo del Mar Huave. Other researchers have challenged the P >> M model, arguing that for infixation (Yu 2007a,b) and phonologically conditioned suppletive allomorphy (Paster 2006, 2009), a more constrained and explanatory analysis is one in which morphology precedes phonology and affix position is determined by GENERALIZED PHONOLOGICAL SUBCATEGORIZATION, in which affixes can subcategorize for a phonological constituent. One of the main arguments for this latter model is that while affix position may have a phonologically-determined position, it is not always phonologically optimizing in the output.

There is some skepticism regarding mobile affixes. Paster (2005) discusses several cases (in Awtuw, Witsuwit’en, and Doyayo) in which monoconsonantal affixes shift position locally apparently due to syllabic considerations, and shows that they can be reanalyzed as either morphological templatic positions in the case of Awtuw, or due to local metathesis for the other cases. Mobile affixes of the type in (1), however, do not lend themselves to such a treatment. They pose a problem for generalized subcategorization, since there is no unified subcategorization – either one has to assume a single affix with competing subcategorization frames (Stump 1993) or two segmentally identical affixes with the same meaning but different subcategorization frames (Paster 2009). Another possible analysis is to treat the affixes as floating segments, which associate to fixed templatic positions (Paster 2009). Finally, one could dismiss mobile affixes altogether as non-phonologically conditioned, as suggested for Afar (Wolf 2008). Since mobile affix examples are rare, these type of treatments are deemed preferable to the option of allowing phonological constraints to determine morphological position. We return to this issue in §6. Given the problematic status of phonologically

(1)  
a. [mojk-o]-t  
face.down-V-CP  
‘s/he lay face down’  
b. t-[e-mojk-o-r]  
CP-2-face.down-V-2I  
‘you (sg.) lay face down’
conditioned mobile affixation, new cases would lend credence to this rare breed, particularly if the phonological factors conditioning the affix position were of a different variety.

In this paper, we introduce a novel case of phonologically conditioned mobile affixation in which tone is the determining factor. In the Thetogovela dialect of Moro, a Kordofanian language spoken in the Nuba Mountains of Sudan, object markers are positioned as either prefixes or suffixes depending on the tone patterns of the stem and the tone of the object markers themselves. When the verb appears with no object markers, high tone is found on the verb root in the aspectual forms in (2a-b), as shown for véló ‘pull’ and tʃómbo ‘tickle’. High tone is marked with a diacritic accent (á) and low tone is unmarked. An object marker appears as a prefix with these forms, as shown for the 2sg marker -ŋá. When the object marker is present, high tone is not realized on the root. All data are from our fieldnotes.

(2)  
<table>
<thead>
<tr>
<th>no object marker</th>
<th>w/2sg object marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. proximal imperfective</td>
<td>k-a-véló-á</td>
</tr>
<tr>
<td></td>
<td>k-a-tʃómbo-á</td>
</tr>
<tr>
<td>b. consecutive imperfective</td>
<td>t-áŋ-véló-ó</td>
</tr>
<tr>
<td></td>
<td>t-áŋ-tʃómbo-ó</td>
</tr>
</tbody>
</table>

In contrast, in the aspectual forms in (3a-b), high tone appears on affixes, and no high tone is found on the root. The object marker appears as a suffix with these forms.

(3)  
<table>
<thead>
<tr>
<th>no object marker</th>
<th>w/2sg object marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. distal imperfective</td>
<td>k-ά-véló-ó</td>
</tr>
<tr>
<td></td>
<td>k-ά-tʃómbo-ό</td>
</tr>
<tr>
<td>b. perfective</td>
<td>k-a-véló-ό</td>
</tr>
<tr>
<td></td>
<td>k-a-tʃómbo-ό</td>
</tr>
</tbody>
</table>

The same pattern holds for other high-toned object markers, but when an object marker is low-toned, as with the 3pl –lo, no variable positioning is found. Furthermore, high tone is found on the root in the forms with –lo in (4a-b), just as in the forms with no object marker.
In this article, we argue that tone provides a better synchronic explanation for the variable position of the object markers than one based on morphosyntactic features of the verb. The distribution of tone on the verb stem as well as the tone of the object marker itself determines the position of the object marker. We conclude that Moro object markers represent a bona fide example of phonologically conditioned mobile affix positioning, and that this phenomenon, while rare, should be incorporated into the interface between phonology, morphology and syntax.

This paper is organized as follows. In §2, the basic data are introduced, illustrating the positions of the object markers and demonstrating how no cohesive analysis based on morphosyntactic properties can be responsible for their variable position. In §3, we present the tone patterns of Moro verb stems, and motivate domains of tone assignment. We show how the position of the tone marker correlates with two different classes of tone patterns: prefix object markers occur with default tone and suffix object markers with melodic tone, both tone patterns distributed within the inflectional stem domain. In §4, we present a formal analysis. In §5, we present data from non-mobile object markers and double object markers, and show how their positions follow straightforwardly from the analysis developed. In §6 we demonstrate cases in which tone distribution occurs within the larger verb stem, but fails to affect the position of the object markers. Finally, in §7, we briefly address other cases of phonologically-conditioned variable affix order, and discuss the implications of these cases for analyses in which phonology can determine affix position.

<table>
<thead>
<tr>
<th>(4)</th>
<th>no object marker</th>
<th>w/3pl object marker</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>proximal imperfective</td>
<td>k-a-vøléð-a</td>
</tr>
<tr>
<td></td>
<td></td>
<td>k-a-tʃómboð-a</td>
</tr>
<tr>
<td>b.</td>
<td>consecutive imperfective</td>
<td>t-ɑŋ-vøléð-ó</td>
</tr>
<tr>
<td></td>
<td></td>
<td>t-ɑŋ-tʃómboð-ó</td>
</tr>
<tr>
<td>c.</td>
<td>distal imperfective</td>
<td>k-á-vøleð-ó</td>
</tr>
<tr>
<td></td>
<td></td>
<td>k-á-tʃómboð-ó</td>
</tr>
<tr>
<td>d.</td>
<td>perfective</td>
<td>k-a-vøleð-ó</td>
</tr>
<tr>
<td></td>
<td></td>
<td>k-a-tʃómboð-ó</td>
</tr>
</tbody>
</table>
2. **Object Markers and Variable Position.** Moro object markers (OM) appear in two positions on the verb stem – preceding the root and iterative prefix, or following the aspect/mood vowel. In (5) we illustrate the location of the OMs within the basic templatic structure of the Moro verb.\(^1\)

\[\text{(5) Moro verb structure and position of OMs.}\]

\[
\text{COMP-SM-TENSE-CLASS-CLAUSE-ASP-OM/PROG-ITER-ROOT-EXT-ASP/MOOD-OM-INST-LOC}
\]

The extension affixes (EXT) consist of neuter/detransitive, causative, benefactive applicative, passive/reflexive, and locative/malfactive applicative. Object markers (OMs) are incorporated pronominals; they do not co-occur with lexical noun phrases, and they bear a close affinity to free pronouns. Relevant data for this conclusion will be presented in section 4.1, where we outline our assumptions about the syntax-phonology interface.

As we have already seen, object markers in Moro are variably suffixes or prefixes. Setting aside phonological factors for now, let us examine how the position of the OM changes depending on the morphosyntactic category of the verb. The morphological categories which affect the position of the OM include those marking aspect and mood, spacial deixis, and clause type. For example, in (6), the perfective verb form takes object marker suffixes, but the proximal imperfective has object marker prefixes.\(^2\)

\[\text{(6) }\]

<table>
<thead>
<tr>
<th></th>
<th><strong>Perfective w/objects</strong></th>
<th><strong>Proximal imperfective w/objects</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg</td>
<td>k-a-ʧәmbәð-ǭ</td>
<td>k-a-ʧәmbәð-a</td>
</tr>
<tr>
<td>2sg</td>
<td>k-a-ʧәmbәð-ǭ-ʧәkә</td>
<td>k-a-ʧәkә-ʧәmbәð-a</td>
</tr>
<tr>
<td>3sg</td>
<td>k-a-ʧәmbәð-ǭ-ʧәyә</td>
<td>k-a-ʧәyә-ʧәmbәð-a</td>
</tr>
<tr>
<td>1inc.dual</td>
<td>k-a-ʧәmbәð-ǭ-ʧәda</td>
<td>k-ʧәda-ʧәmbәð-a</td>
</tr>
<tr>
<td>2pl</td>
<td>k-a-ʧәmbәð-ǭ-ʧәda</td>
<td>k-ʧәda-ʧәmbәð-a</td>
</tr>
</tbody>
</table>
Based on these examples alone, it appears as if the position of the OM should be tied to the aspectual specification of the verb.

There are two ways in which morphosyntax might condition the placement of the OM on the Moro verb. First, the position of the OM could be dependent on a particular syntactic category, such as perfective. Alternately, the position of the OM might vary due to a requirement that it attach to a specific morpheme as a prefix or suffix, overriding its default specification in the other direction.

However, a close examination of the morphosyntactic categories which correlate with the two positions of the OM do not reveal generalizations along either of these lines. To see that this is the case, consider the following verbs forms which take OM suffixes:

(7) Verb forms with object marker suffixes

<table>
<thead>
<tr>
<th></th>
<th>no object</th>
<th>w/ 3sg object</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. perfective</td>
<td>k-a-ʧɔmbəð-ó</td>
<td>k-a-ʧɔmbəð-ə-ʧə</td>
<td>‘s/he tickled’</td>
</tr>
<tr>
<td>b. distal imperfective</td>
<td>k-á-ʧɔmbəð-ó</td>
<td>k-á-ʧɔmbəð-ə-ʧə</td>
<td>‘s/he is about to tickle there’</td>
</tr>
<tr>
<td>c. proximal imperative</td>
<td>ʧɔmbəð-ó</td>
<td>ʧɔmbəð-ə-ʧə</td>
<td>‘tickle!’</td>
</tr>
<tr>
<td>d. distal imperative</td>
<td>ʧɔmbəð-a</td>
<td>ʧɔmbəð-á-ʧə</td>
<td>‘tickle there!’</td>
</tr>
</tbody>
</table>

While we saw in (6) that the proximal imperfective conditions prefix OMs, the distal imperfective form in (7b) conditions suffix OMs, just like the perfective. These two forms convey a similar aspectual dimension of imperfective, but differ in terms of spacial deixis. Therefore, it is not possible to conclude that aspect distinctions alone determine OM position.

If aspect is not responsible for the position of the OMs, perhaps spacial deixis is. Again, closer examination reveals that deixis does not determine OM position either. Although proximal imperfective and distal imperfective take prefix and suffix OMs respectively, both proximal and distal imperative forms (7c,d) take OM suffixes, despite differing in their deictic specification. Likewise, consecutive verb forms take OM prefixes regardless of whether they are in the proximal or distal form, as shown in (8b-c). The following table provides the list of verb forms that cooccur with OM prefixes. Note that the suffix of the verb forms plays a role in determining the aspect/mood:
Verb forms with object marker **prefixes**

<table>
<thead>
<tr>
<th></th>
<th>no object</th>
<th>w/ 3sg object</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>proximal imperfective</td>
<td>k-a-ʧόμβəð-a</td>
<td>k-a-ʧό -ʧόμβəð-a</td>
</tr>
<tr>
<td>b.</td>
<td>subordinate proximal</td>
<td>(n)-άŋ-ʧόμβəð-a</td>
<td>(n)-άŋ-ʧό -ʧόμβəð-e</td>
</tr>
<tr>
<td>c.</td>
<td>subordinate distal</td>
<td>(n)-άŋ-ʧόμβəð-a</td>
<td>(n)-άŋ-ʧό -ʧόμβəð-a</td>
</tr>
<tr>
<td>d.</td>
<td>consecutive imperfective</td>
<td>ʧ-άŋ-ʧόμβəð-ό</td>
<td>ʧ-άŋ-ʧό -ʧόμβəð-ό</td>
</tr>
<tr>
<td>e.</td>
<td>consecutive proximal perfective</td>
<td>n-ʧό -ʧόμβəð-e</td>
<td>n-ʧό -ʧόμβəð-e</td>
</tr>
<tr>
<td>f.</td>
<td>consecutive distal perfective</td>
<td>n-ʧό -ʧόμβəð-a</td>
<td>n-ʧό -ʧόμβəð-a</td>
</tr>
<tr>
<td>g.</td>
<td>negative</td>
<td>k-an:á áŋ-ʧόμβəð-a</td>
<td>kan:á áŋ-ʧό -ʧόμβəð-a</td>
</tr>
<tr>
<td>h.</td>
<td>negative imperative</td>
<td>án:á á-ʧόμβəð-a</td>
<td>án:á á-ʧό -ʧόμβəð-a</td>
</tr>
</tbody>
</table>

These data also show that mood is also not responsible for OM position. Positive imperative forms take OM suffixes (7c-d), whereas negative imperatives take prefixes (8h).

Most forms that take prefixes can be categorized as dependent verbs, in that they follow an auxiliary verb (in the case of the negative an:á) or are dependent on a preceding clause, as in the case of the subordinate and consecutive forms. This is reflected in an alternate subject marking
paradigm particular to subordinate verbs, exemplified in (10) by the different realizations of the 3rd singular subject marker. While 3sg agreement is represented by noun class concord marker in main verbs (k- in (10a)), it is realized as an invariant prefix áŋ(á)- or áŋá- for dependent verbs (10b-g). However, the main/dependent division also does not correlate perfectly with OM position, as the proximal imperfective in (10a) is a main verb form. In sum, while dependent verbs all take OM prefixes, not all verbs with OM prefixes are dependent verbs, so this cannot serve as a unified explanation.

In conclusion, no single morpho-syntactic property correlates with whether a verb form will have a prefix or suffix OM. Mood, aspect, deixis and main/dependent status all fail to fully explicate the patterns. Moreover, purely morphological features of the verb, the most obvious candidate being the final vowel of the verb, fail to accurately predict the position of the OM. Below we show that there are generalizations to be made across these different categories, but they do not lie in the morphosyntax of these verb forms, but rather in their tonal properties.

3. TONE PROPERTIES OF VERB STEMS AND THE POSITION OF OBJECT Markers. In this section, we demonstrate that the tone characteristics of the different verb forms correlate with the position of the object markers. Moro has two basic tones, high and low. It is a H/Ø tone system in which L tone is not active (Jenks & Rose 2011). The tone patterns of Moro verb forms fall into two distinct groups. The first pattern is termed DEFAULT tone, due to its general predictability and dependence on the segmental and syllabic properties of verb roots. Verb forms with default tone co-occur with object marker prefixes. The second pattern is termed MELODIC tone, wherein the tone pattern on the stem depends solely on the particular aspect/mood/deixis/clause of the verb form, and ignores the segmental makeup of the verb stem. Verb forms with melodic tone co-occur with object marker suffixes.

3.1. DEFAULT TONE. Default tone patterns are found in the proximal imperfective and all other verb forms in (8) that co-occur with object marker prefixes. The default pattern is characterized by a high tone positioned at the left edge of the root, which extends to a second tone-bearing unit, as shown in (9a-b). Jenks & Rose (2009, 2011) attribute this pattern to a left-aligned binary foot which prefers H tone aligned to both its edges. The tone pattern depends on syllable structure in that high tone does not spread out of an initial closed or heavy syllable (9c-d). The
transcribed tone pattern (e.g. H-H or H-L) indicates the tone on the root and the tone on the following affix, typically the final aspect/mood vowel.

<table>
<thead>
<tr>
<th>(9)</th>
<th>Root shape</th>
<th>Root-suffix tone</th>
<th>Proximal imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>CVCVC</td>
<td>HH-L</td>
<td>k-a-dógát-a</td>
</tr>
<tr>
<td>b.</td>
<td>CVC</td>
<td>H-H</td>
<td>k-a-ðów-á</td>
</tr>
<tr>
<td>c.</td>
<td>CVCCVC</td>
<td>HL-L</td>
<td>k-a-mwándò-iə</td>
</tr>
<tr>
<td>d.</td>
<td>CVCC</td>
<td>H-L</td>
<td>k-a-wárð-a</td>
</tr>
</tbody>
</table>

If a root begins with a vowel, H tone has a different distribution. The generalization is that H avoids vowel-initial syllables unless they have a coda. Thus, the first vowel of the root is low toned if it occurs in a light syllable (12a-b). This H tone does not spread to the suffix in bisyllabic verbs (12a). Onsetless initial syllables do bear high tone when heavy, though. That H tone does not spread rightwards (12c-d), following the general pattern for heavy syllables exhibited in (11c-d).

<table>
<thead>
<tr>
<th>(10)</th>
<th>Root shape</th>
<th>Root-suffix tone</th>
<th>Proximal imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>V.CV.C</td>
<td>LH-L</td>
<td>k-ogát-a</td>
</tr>
<tr>
<td>b.</td>
<td>V.C</td>
<td>L-L</td>
<td>k-al-a</td>
</tr>
<tr>
<td>c.</td>
<td>VC.CV.C</td>
<td>HL-L</td>
<td>k-ónḍət-a</td>
</tr>
<tr>
<td>d.</td>
<td>VC.C</td>
<td>H-L</td>
<td>k-áff-a</td>
</tr>
</tbody>
</table>

Note that the agreement prefix /k-/ does not license H on the initial root vowel. In Jenks & Rose (2009, 2011) it is shown that the failure of this prefix to license H is due to the fact this prefix and the stem occur in different tonal domains, discussed in more detail in section 3.3.

While most verb roots exhibit spreading of the H a single syllable to the right, there are a handful of exceptional roots that do not obey this pattern. However, the distribution of tone on these exceptional forms is systematic: they always involve a tone which does not spread e.g. ka-
noán-a ‘s/he is caring for’ or k-a-vódað-a ‘s/he is sweeping.’ In addition, this tone can appear on an onsetless initial light syllable, where H tone is otherwise prohibited e.g. nyáwá ny-ól-a ‘water is dripping’. These exceptions have H aligned at the left edge, as in the general pattern. There are no roots that have the shape CVCVC with a tone pattern LH or CVC with low tone. Therefore, the overarching principle of default tone distribution is H tone at the left edge of the root.

In conclusion, verb forms with default tone show a variety of different tone patterns depending on the syllable structure of the root (light vs. heavy syllables, C-initial or V-initial roots). There are also several verbs that have a high tone positioned at the left edge that does not extend to a second tone bearing unit regardless of syllable structure.

3.2. MELODIC TONE. In contrast to default tone, ‘melodic’ tone refers to particular tone patterns which are associated with particular aspect/mood/deixis categories. Unlike the cases of default tone, these tone melodies occur regardless of the syllable structure of the root. The verb forms which specify melodic tones, introduced in (7), are listed below. The distal imperfective is identical to the perfective except for the additional high-toned prefix preceding the root.  

\[
\begin{array}{lcl}
\text{(11)} & \text{a. perfective} & [\text{L-H}] \quad \text{k-a-v̥leð-ó} \\
& \text{b. distal imperfective} & \text{H-[L-H]} \quad \text{k-á-v̥leð-ó} \\
& \text{c. proximal imperative} & [\text{H-H}] \quad \text{v̥léð-ó} \\
& \text{d. distal imperative} & [\text{L-L}] \quad \text{v̥leð-a} \\
\end{array}
\]

Unlike the default tone pattern, the tone patterns in (11) occur regardless of the segmental or syllabic make-up of the root, as shown below with the perfective (L-H) and proximal imperative (H-H) for a variety of different root types.

\[
\begin{array}{lcl}
\text{(12)} & \text{Root shape} & \text{Perfective L-H} & \text{Proximal imperative H-H} \\
& \text{a. CVCVC} & \text{k-a-dogá-t-ó} & \text{dogá-t-ó} & \text{‘fix’} \\
& \text{b. CVC} & \text{ka-dów-ó} & \text{dów-ó} & \text{‘poke’} \\
& \text{c. CVCCVC} & \text{k-a-m̥wänd̥-ó} & \text{m̥wänd̥-ó} & \text{‘ask’} \\
\end{array}
\]
d. CVCC k-a-warō-ó wářō-ó ‘write’
e. VCVC k-ogāt-ó ōgát-ó ‘jump’
f. VC k-al-ō ál-ō ‘slice’
g. VC.CVC k-ondāt-ó ōndāt-ó ‘dry’
h. VC.C k-aff-ō áff-ō ‘build, shoot’

It is important to observe that the tone of the aspect suffix does not determine the distinction between default and melodic tone. The consecutive imperfective has a final high toned suffix -ó, as does the perfective, but the consecutive imperfective has default tone (j-āŋ-ōgāt-ó ‘..and he is jumping’, cf. 8d), whereas the perfective has melodic tone (k-ōgāt-ō ‘he jumped’). It is the tone pattern of the stem as a whole rather than the form of the individual affixes that is responsible for the default/melodic distinction.

In summary, while default tone verb forms display a variety of tone patterns dependent on root type, the melodic tone verb forms have a uniform tone pattern regardless of root type. The OM prefixes co-occur with default tone verb forms, whereas the OM suffixes co-occur with melodic tone forms, regardless of the morphosyntactic features that these tone patterns are associated with. Thus, the tone pattern on the verb stem precisely correlates with the position of the OM as prefix or suffix, cross-cutting various morphosyntactic categories.

3.3. Domains of Tone Interaction. Not only does the tone pattern of the verb stem correlate with the position of the OM, but the tone of the OM interacts with the tone pattern of the verb stem depending on its position. The basic pattern is as follows: when OM prefixes occur, there is no default high tone pattern on the verb stem. On the other hand, suffixal OMs do not impact the tone pattern of the stem. This is illustrated with the proximal imperfective, which has default tone, and the proximal imperative, which has melodic tone:
In the second column of (13a-b), the high tone that normally appears on the root in the proximal imperfective does not occur in the presence of the OM prefix. Conversely, the melodic high tone of the proximal imperative is unaffected by the OM suffix (13c-d).

In this section, we demonstrate that the difference in the tone behavior of the prefix versus suffix OM can be derived from their location in different nested domains which have distinct properties in terms of H tone distribution and interaction. We provide evidence for these morpho-phonological domains and show how the position of the OM fits within them. The first of these is the MACROSTEM, which includes the prefix OM, progressive and iterative prefixes, verb root and extension markers, as shown in (14). The macrostem is familiar from Bantu languages and normally includes the OM, root, extension markers and final vowel (e.g. Hyman and Ngunga 1994, Mutaka and Hyman 1990, Odden 1996, Myers 1987, 1997). In many Bantu languages, the macrostem is a domain for certain tonal processes. The main difference between Bantu and Moro is that the proposed Moro macrostem does not include the final vowel.

The second, larger domain is the INFLECTIONAL STEM, which includes the macrostem as well as the distal imperfective prefix and the aspect/mood/deixis suffix. The macrostem is the domain of stem tone assignment, while the inflectional stem includes the affixes which determine default or melodic tone. The Moro inflectional stem is similar to the Bantu inflectional stem, but differs from it in that the Bantu inflectional stem is smaller than the macrostem and excludes the OM. The INFLECTIONAL STEM consists of the verbal projections roughly corresponding to the vP domain in syntax.

The VERB STEM, similar to the Bantu verb stem, consists of the inflectional stem plus a string of prefixes: complementizer, subject, tense, class, and clause type. Thus, the verb stem consists of heads in the TP/CP domain in syntactic structure. Finally, at the right edge of the verb stem are enclitics, including the OM suffix. The difference in the behavior of the OM prefixes and
suffixes are primarily due to their position inside or outside of these domains. The different domains are delimited in (14):

(14) *Verb domains*

\[
\text{(COMP-SM-TENSE-CLASS-CLAUSE-[ASP-\{OM/PROG-ITER-ROOT-EXT\}-ASP/MOOD]}-\text{OM-INST-LOC)}
\]

We now provide phonological evidence that each of these stems forms a distinct domain, and we demonstrate the behavior of the OMs within the domains.

**Evidence for the Macrostem and Inflectional Stem.** Recall from (8) that default root H is absent in the presence of preverbal OMs. This interaction between root tone and prefixation also occurs with the iterative/durative prefix, expressed by partial reduplication of the root. This prefix has the shape CaC-, where C indicates a copy of the first root consonant, or Vkk- if the root is vowel-initial, where V copies the first vowel (15). This prefix is high-toned, and like with the prefix OM, no default H appears on the root when the reduplicant occurs.

(15) **proximal imperfective**  

<table>
<thead>
<tr>
<th></th>
<th>proximal imperfective</th>
<th>iterative proximal imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>k-a-ðòw-á</td>
<td>k-a-ðáð-ðòw-a  ‘poke’</td>
</tr>
<tr>
<td>b.</td>
<td>k-a-lág-á</td>
<td>k-a-lá1-lag-a  ‘weed’</td>
</tr>
<tr>
<td>c.</td>
<td>k-a-vóléð-a</td>
<td>k-a-váf-førleð-a  ‘pull’</td>
</tr>
<tr>
<td>d.</td>
<td>k-ogát-a</td>
<td>k-ókk-ogát-a  ‘jump’</td>
</tr>
</tbody>
</table>

When both the OM and the iterative prefix are present, the OM precedes the iterative prefix, and H tone appears only on the OM prefix; both the reduplicative prefix and the root lack H tone.

(16) **proximal imperfective**  

<table>
<thead>
<tr>
<th></th>
<th>2sgOM + iterative prosimonal imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>k-a-ðòw-á</td>
<td>k-a-ŋá-ðáð-ðòw-a  ‘poke’</td>
</tr>
<tr>
<td>k-a-vóléð-a</td>
<td>k-a-ŋá-vaf-førleð-a  ‘pull’</td>
</tr>
</tbody>
</table>
The general pattern is therefore that only the leftmost of the prefixes bears H tone.

Not all high-toned prefixes trigger this effect. High-toned prefixes that occur to the left of the OM (bolded in (17)) can co-occur with default H tone on the root:

(17) **COMP-SM-TENSE-CLASS-CLAUSE-ASP{OM/PROG-ITER-ROOT-EXT}-ASP/MOOD**

The boundary between the OM and ASP represents the left edge of the macrostem. To the left of this boundary are complementizers, main clause subject markers, past tense reduplication, and “clause type” prefixes indicating main clause or subject or object extraction. All of these prefixes bear H tone, and this H tone freely cooccurs with the high tone on the root. These prefixal H tones only interact with the default H pattern on the root if they are adjacent to the macrostem left edge boundary in which case they trigger downstep (marked henceforth with ′).10

(18) complementizer: ɗ́-n-áff-ó ‘..and I am building’
subject markers: ɗ-g-a-kʷáréð-a ‘I am scratching’
       ɗ-g-áff-a11 ‘I am building’
past tense reduplication: ɗ-gá-g-a-kʷáréð-a ‘I was scratching’
       ɗ-gá-g-áff-a ‘I was building’
subj extraction (clausetype): k-ɗ-kʷáréð-a ‘(she)…who is scratching’

Downstep provides evidence for two separate autosegmental H tones (Odden 1986, Myers 1997, Bickmore 2000, 2007), indicating that the H of the prefix is distinct from the H on the root, rather than a result of spreading. Independent H tones can also co-occur on the verb stem prefixes, and they do not trigger downstep on each other, indicating that downstep is restricted to the macrostem boundary demarcated in (17).

Just as the verb stem prefixes can co-occur with H tone on the root, they can also occur with the H tone of the iterative prefix or OM prefix:
When the prefixes are adjacent to the macrostem boundary in (17), they trigger downstep on the following H, regardless of whether the macrostem H is associated with the root or a prefix.

Thus, there is evidence for a distinction between verbal prefixes, marked by a distinct boundary. To the right of this boundary are the iterative/durative reduplicant and the OM prefix, neither of which can co-occur with H tone on the root. When these two prefixes occur together, only the leftmost, always the OM, surfaces with H tone. In contrast, prefixes occurring to the left of this boundary freely bear H tone, and do not affect H tone on other prefixes. They co-occur with H tone to the right of this boundary, but can trigger downstep. We conclude, therefore, that there is tonal evidence for a morpho-prosodic constituent, the macrostem, delimited on the left by the object marker. The leftmost tone-bearing unit in this constituent bears H tone. This H tone is demarcated by downstep when another high-toned prefix is adjacent across the boundary.

There is a different kind of interaction between suffix H tones and H tone on the root. Here we consider the high-toned aspect/mood/deixis suffixes and the OM suffixes. The perfective suffix –ó and proximal imperative –ó both have high tone (20a,b). Both are melodic tone suffixes, but while the former suffix occurs with low tone on the root (L-H pattern), the latter occurs with high tone on the root (H-H pattern). Conversely, the consecutive imperfective (20c-e) also has high tone –ó, but this co-occurs with the default tone pattern described in section 3.1. Downstep occurs between the root and the –ó suffix when these two high tones are adjacent (20c). Downstep also occurs at the macrostem left edge boundary between the the subject marker and the root (20c), the iterative prefix (20d) and the OM prefix (20e):
The existence of downstep indicates that the H of the suffix is distinct from the H on the root, rather than a result of spreading. In contrast to these forms, downstep does not occur with the imperative (20b), suggesting an analysis of the imperative as a single autosegmental H spread across the stem, and not two juxtaposed H tones. Thus, while the perfective and the proximal imperative both involve a H suffix –ó, the tone melodies of these verb forms cannot be derived directly from the presence of the form of this suffix, given that it occurs with several different patterns. In conclusion, there is tonal evidence from downstep that the aspect/mood suffixes are outside the macrostem. At the same time, however, it is the aspect/mood suffixes and the aspect/deixis prefix /á-/- that determine the type of tone melody that appears within the macrostem – default tone or melodic tone.

Turning to OM suffixes, they show no interaction with melodic tone. There is also no downstep between the melodic H and the OM suffix tone, which is reminiscent of the lack of downstep between prefixal H tones outside of the macrostem. Recall that the reduction of /o/ to schwa is a regular phonological process in Moro.

The inertness of suffixal OMs with respect to melodic tone differs markedly from the behavior of prefixal OMs, which cannot co-occur with default tone on the verb stem, and undergo downstep in the presence of a preceding prefixal tone. It is an indication that, like the aspect/mood suffixes which precede them, the OM suffixes are not part of the macrostem.

In conclusion, internal to the macrostem, H tone is realized on the leftmost syllable in verbs exhibiting the default tone pattern, modulo the constraints placed on default H by syllable structure described in section 3.1. Evidence for the left boundary of the macrostem comes from
the different behavior of verbal prefixes and the fact that downstep applies between adjacent H tones only at this boundary. Downstep also provides evidence for the right boundary, as default tone triggers downstep on the suffix –ő in the consecutive imperfective (20c). Outside of this domain, adjacent H tones co-occur and do not trigger downstep.

Turning now to the larger inflectional stem, we assume that it is the locus of tone assignment for four reasons. First, it is the aspect/mood/deixis prefix and suffixes which determine the distribution of tone within the macrostem or within the whole inflectional stem. The particular aspect/mood prefix or suffix requires either default H tone, or melodic tone for perfective and distal imperfective in which no H tone is found within the macrostem. For imperatives, which both impose melodic tone, there is either a single autosegmental H spread across the whole inflectional stem (proximal imperative), or no H tone at all (distal imperative). Second, the iterative prefix is high toned when it occurs with default tone pattern forms, ex. k-a-đáđ-đɔw-a, but with melodic tone forms, it varies between low or high tone depending on the melodic tone pattern associated with the inflectional stem, ex. distal imperative đáđ-đɔw-a versus proximal imperative đáđ-đɔw-ő. Third, while downstep occurs between default H tone and a high-toned aspect/mood suffix in the consecutive imperfective, the same pattern is not observed between melodic tone on the root and a high-toned aspect/mood suffix in the proximal imperative, suggesting that a single tone pattern is assigned to the whole inflectional stem. Fourth, melodic tone patterns conditioned by aspect/mood affixes are confined to the inflectional stem itself.

Evidence for the Verb Stem and Enclitic Group. Phonological evidence for the existence of the verb stem domain comes from vowel harmony. Moro exhibits vowel height harmony which raises the lower vowels /a e o/ to [ʌ i u] respectively. Every member of the inflectional stem undergoes vowel harmony as well as all prefixes attached to the inflectional stem — that is, everything within the proposed verb stem. However, suffixes to the right of the aspect/mood suffix generally do not; vowel harmony is optional on the first OM. In (22a, 22e), a verb root veđ with a lower vowel /e/ is shown. The affixes attached to this root are all of the lower set /e a o/. In (22b,22f), a root with a high vowel /u/ causes the affixes to raise to their higher counterparts [i ʌ u]. While prefixal OMs do undergo harmony (22h), suffixal OMs do not (22d). This indicates that the prefix OMs, but not the suffix OMs, are included in the verb stem:
The clitic group therefore requires a H tone at the left edge (which can appear just inside the verb stem if the clitic is low-toned) and a low tone at the phrasal right edge, presumably a L% boundary tone. These two requirements compete when there is a single high-toned OM, however, and the H tone of the OM is maintained: \( k-a-d\ar-\ddot{\text{u}}-\text{d}-\eta\text{o} \) ‘he covered me’. The ban on a final H tone is only evident if there is more than one clitic.\(^{12}\)
In conclusion, there is phonological evidence for the existence of two other domains: the verb stem, and the enclitic group. The overall structure\textsuperscript{13} is shown in (27), with the phonological processes marking each level indicated.

(24) Moro verb structure:

\begin{center}
\begin{tikzpicture}

\node {Verb}
\child {node {HL TONE ASSIGNMENT}}
\child {node {Verb stem}}
\child {node {VOWEL HARMONY}}
\child {node {Inflectional stem}}
\child {node {H TONE ASSIGNMENT}}
\child {node {Macrostem}}
\child {node {H TONE DOWNSTEP}}
\child {node {OM-Inst-Loc}}
\child {node {(Comp-SM-Tense-Clause-[Aspect- {OM/Prog-Iter-Root-Ext} -Aspect/Mood])}}
\end{tikzpicture}
\end{center}

In conclusion, we have established that tone interaction occurs within a constituent labeled the MACROSTEM, which includes OM prefixes. This constituent allows only one H autosegment with default tone, and its boundaries are marked by tonal downstep when two H tones are juxtaposed across it. A larger constituent we have labeled the INFLECTIONAL STEM serves as the locus for the assignment and distribution of melodic and default tone, and includes the macrostem as well as the aspect/mood/deixis prefix and suffixes. The VERB STEM includes the inflectional stem and all prefixes, and is the domain of vowel harmony. Finally, the OMs and the instrumental and locative clitics are adjoined to the right edge of the verb stem as a clitic group, which is marked by distinct tonal properties. They require a H tone at the left edge and no H tone at the right edge. They show no tone interaction with the rest of the verb stem (other than to place a H tone on the final low-toned syllable of the verb stem) and only the first OM in the sequence optionally participates in vowel harmony.

At this point two main observations about the interaction between tone and object markers have been established. The first observation is that the class of verb forms in which OMs occur as prefixes exhibit DEFAULT TONE, in which the leftmost syllable exhibits a H, which generally spreads a single syllable to the right. This pattern occurs with a variety of different aspect/mood/deixis types. In contrast, the class of verb forms in which OMs occur as suffixes
exhibit MELODIC TONE, which is a specific tone pattern that marks distinct morphosyntactic categories. The distribution of H tone within the macrostem depends on the aspect/mood/deixis which is marked by inflectional stem affixes in addition to the tone itself. Second, the position of the OM determines how the tone of the OM interfaces with the tone of the stem. When a prefix, the OM appears with H tone, while the rest of the macrostem is low-toned, failing to exhibit the characteristic default tone. When a suffix, the H tone of the OM does not interact with the tone pattern of the rest of the verb stem, due to its location outside the verb stem in the clitic group.

In the following section, we pursue a formal analysis of the variable position of OMs in Moro as driven by the tonal properties of the verb forms with which they occur.

4. ANALYSIS OF THE DISTRIBUTION OF OBJECT MARKERS. The goal of this section is to integrate an analysis of the variable OM position in Moro into an analysis of the distribution of tone. Below we provide a formal OT analysis of the tone interaction patterns from section 3 and derive from this analysis the two different positions of Moro OMs. Section 4.1 provides a basic account of the process by which OMs are incorporated into the verb, and proposes that their default position is at the right edge of the stem. In section 4.2, we introduce constraints which produce the leftmost default tone pattern which occurs within the macrostem. These same constraints favor the preverbal position of the OM due to its optimizing effect on the tone of the macrostem. In section 4.3 we demonstrate how melodic tone patterns can be expressed by associating specific constraint rankings with specific morphosyntactic categories, and how these constraint rankings, along with the general prosodic constraints of section 4.1, favor the suffixal OM.

4.1 SYNTACTIC POSITION OF OMs. We begin by laying out our assumptions about the syntactic, morphological, and phonological status of OMs in Moro. We take OMs to be prosodically deficient functional morphemes that occupy the verb complement position in syntax, but combine with the verb for prosodic reasons. There are two pieces of evidence for this position.

The first piece of evidence is the observation that OMs occur in complementary distribution with full noun phrases.
(25) a. Kúku  g-a-ḻ̱v̱̱ətʃ-ó  ummũə
   Clg.Kuku  Clg.SM-MAIN-hide-PFV  Clg.boy
   ‘Kuku hid the boy’

b. Kúku  g-a-ḻ̱v̱̱ətʃ-ó  ŋəɾá
   Clg.Kuku  Clg.SM-MAIN-hide-PFV  Clg.girl
   ‘Kuku hid the girl’

c. Kúku  g-a-ḻ̱v̱̱ətʃ-óŋ̱ó
   Clg.Kuku  Clg.SM-MAIN-hide-PFV-3SG.OM
   ‘Kuku hid him/her’

The complementarity of overt noun phrase objects and OMs would be expected if OMs compete for the same syntactic position as objects, rather than serving as agreement markers. In contrast to subject agreement, which reflects Moro’s noun class system (Gibbard et al. 2009), Moro OMs show no noun class agreement, so the OM in (25c) could refer to the object from (25a) (ummiə ‘boy’, class g-) or that from (25b) (ŋəɾá ‘girl’, class ŋ-).

The fact that the OM does not reflect noun class is unsurprising in light of the fact that they bear a morphological similarity to the free pronouns of Moro, shown below. This provides the second piece of evidence that OMs are incorporated pronouns:

(26)    Pronouns  OMs    Pronouns  OMs
1SG  ŋŋi  ŋé  1EX.PL  ŋŋandá  álánda
2SG  ŋŋá  ŋá  1IN.PL  ŋdr  ŋdr
3SG.HUM  ŋŋúŋ  ŋó  2PL  ŋŋóndá  ŋda
1IN.DU  (ndó)ḻíŋ  ŋða/ŋða  3PL  ŋú’áŋ/ŋúlando  lo

Singular nonhuman 3SG object pronouns are unmarked in Moro, and their presence is implied. In contrast, the 3PL OM –lo can refer to human or non-human plural objects.

The forms in (26) also show that while OMs are predominantly monomoraic, the free pronouns are minimally bimoraic. Compare the 2SG free pronoun ŋŋá to the OM ŋá. This alternation between free and bound pronominal forms in Moro is an instance of the observation
that many functional words occur in both weak (=bound) and strong (=free) forms (Zwicky 1970, Selkirk 1995, among many others). Thus, we conclude that Moro OMs are introduced into syntactic structure as prosodically deficient pronouns, forcing them to attach to the verb.

Following Selkirk (1995), we interpret prosodic deficiency to mean that as functional items, OMs do not project a phonological word in order to avoid stress. While OMs are syntactically distinct from the verb, they become phonologically dependent on it through a process of STRAY ADJUNCTION (Anderson 2005, pp. 13, 75-85), which incorporates the OM into the prosodic constituent projected by the verb. Stray Adjunction is a cover term for the processes of proclisis and enclisis in a given language, and clitics are divided into several categories based on their prosodic adjunction. In terms of interaction with the rest of the verb stem, Moro suffix OMs can be classified as AFFIXAL CLITICS in that they do not affect the internal prosodic structure of the host, but they can define their own prosodic domain with respect to other OMs and other clitics, as is evident from their tonal behavior. In contrast, OM prefixes are INTERNAL CLITICS, fully incorporated into prosodic structure, and interacting with the prosody of the stem. Following Anderson (2005), we assume that Moro OMs are not specified as prefixes or suffixes, a necessary condition for their mobility. However, we the suffixal position of OMs as the default due to their post-verbal syntactic position combined with prosodic adjunction via the constraint RIGHTMOST(CL, verbstem), which aligns clitics with the right edge of the verb stem. See also Legendre (2000) for formulation of such constraints. This could also be formulated with reference to the right edge of a syntactic unit such as vP. We propose that this morphologically preferred position can be overridden by phonological constraints, which push the OM to attach internally to the inflectional stem, at the left edge of the macrostem.

4.2. ANALYSIS OF DEFAULT TONE AND OM PREFIXES. We first analyze default stem tone. Following Jenks & Rose (2009, 2011), we assume that H tone is assigned to the macrostem via constraints. In this manner, it is similar to cases of predictable tone systems in Bantu languages such as Makua, Yao and Kimatuumbi (Odden 1989), wherein there are no lexical tone contrasts in verb roots, but H tone is assigned to the verb stem in most tenses. The main argument from Moro for inserted tone is the predictable position of H tone within the macrostem. As discussed in section 3.2, every root in these particular verb forms has a single H autosegmental tone. The exceptions to this pattern are the minimal roots C: and VC that a) either do not have a vowel to
bear H tone or b) are prevented from hosting H tone due to the phonotactic restriction against H tone on vowel-initial onsetless light syllables (Jenks & Rose 2009, 2011). In addition, the location of the H tone is the first tone-bearing unit of the macrostem. The exceptions to this are again predictable – vowel-initial onsetless light syllables. The rest of the variation in the realization of tone is whether H tone spreads in a binary fashion to the right or not, which is based on syllable structure, with some lexical exceptions. See Jenks & Rose (2009, 2011) for more details. Given that the presence and location of H tone is predictable, it is redundant to specify it underlingly. Moreover, specifying H tone underlingly creates the additional problem of H tone deletion in the macrostem. Moro systematically avoids H tone deletion. It is, in fact, only observed with a phrase-final clitic, the possible result of a L% boundary tone.

We therefore derive the appearance of the H tone via the following constraints. In order to generate the stem tone pattern of a single H tone at the left edge of the macrostem, the following constraints are adopted:

\[
\begin{align*}
(27) \text{Macross-H} &= \text{Mstem-H} \\
\text{Align(H, L; macrostem, L)} &= \text{AL(H,L)} \\
\text{Dep-IO(H)} \\
\text{Max-IO(H)} \\
\text{Rightmost(cl, verbstem)}
\end{align*}
\]

\text{Macross-H} requires the insertion of a H tone, so it is ranked above \text{Dep-IO(H)}. This inserted H will be aligned at the left edge due to \text{AL(H,L)}. Positional tonal alignment of this sort is also observed in other languages. In Chizigula (Kenstowicz & Kisseberth 1990), for example, H tone is assigned to the initial position of the root, although shifted to the penultimate position of the verb, a type of stress-prominence attraction. In addition, H tone from certain prefixes is shifted onto the (macro)stem-initial position. A similar constraint is proposed in Akinlabi & Mutaka (2001) for Kinande.

In example (28), the root is the only morpheme in the macrostem. The winning candidate is one that has a high tone aligned at the left edge of the root. If the H tone is misaligned outside the macrostem, it satisfies \text{Align} vacuously, but violates \text{Mstem-H}; candidates (28b) and (28c) are
equivalent in this respect. We show the entire verb form, but we assume that the constraint ranking under consideration is valid for the inflectional stem, as this is the locus of the tone distribution. The inflectional stem is demarcated with [], and the macrostem with {}. The spreading of H tone onto the second syllable of the stem is constrained by foot structure – see Jenks & Rose (2011) for more details.

(28)

<table>
<thead>
<tr>
<th>/k-a-vəleð-a/</th>
<th>MSTEM-H</th>
<th>AL(H,L)</th>
<th>DEP-IO(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k-a-[{vəléð}-a]</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. k-a-[{vəleð}-a]</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. k-á-[{vəleð}-a]</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When an iterative prefix is present, the favored candidate is one in which H tone is positioned on the prefix at the left edge of the macrostem. We assume that the prefix also lacks tone underlingly, as its surface tone is predictable, and varies between high and low depending on melodic or default tone.

(29)

<table>
<thead>
<tr>
<th>/k-a-ITER-vəleð-a/</th>
<th>MSTEM-H</th>
<th>AL(H,L)</th>
<th>DEP-IO(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k-a-[{vaf-fərleð}-a]</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. k-a-[{vaf-fərleð}-a]</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. k-a-[{vaf-fərléð}-a]</td>
<td>*!</td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

The tableau above show that these constraints are able to produce the default tone pattern straightforwardly.

Now consider the case of OMs. In section 4.1, we proposed that OMs are incorporated into the prosodic structure due to a constraint regulating the relationship of the clitic and morpho-syntactic structure. We did not consider whether the OM might be subject to additional phonological constraints. In fact, prefixal OM markers satisfy the phonological constraints of default tone. The main difference between the OM and the iterative prefix is that the H tone of the OM is not inserted, but is present underlying. The evidence for this claim comes from the
fact that i) the alternating OMs appear with a H tone when they are suffixes; ii) their corresponding free pronouns also have H tone, and iii) not all OMs have H tone. The H tone of the OM satisfies the MSTEM-H constraint without violating DEP-IO(H). The candidate in (30c) would also violate MAX-IO(H), which is not shown here, but is assumed to be high-ranked, since H tone is only deleted phrase-finally in Moro.

(30)

<table>
<thead>
<tr>
<th>/k-a-واءطا-ا نِ</th>
<th>MSTEM-H</th>
<th>AL(H,L)</th>
<th>DEP-IO(H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k-a-[{يَا-واءطا}-ا]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. k-a-[{يَا-واءطا}-ا]</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. k-a-[{يَا-واءطا}-ا]</td>
<td>*!</td>
<td>*</td>
<td></td>
</tr>
</tbody>
</table>

Recall that the default position of OMs is the right edge of the verb stem. However, we have seen that the position of the OMs at the left edge of the macrostem satisfies phonological constraints regulating the position of default tone. In order to explain the fact that the OM occurs at the left edge of the macrostem rather than at the right edge of the verb stem, DEP-IO(H) outranks RIGHTMOST.

(31)

<table>
<thead>
<tr>
<th>/k-a-واءطا-ا نِ</th>
<th>MSTEM-H</th>
<th>AL(H,L)</th>
<th>DEP-IO(H)</th>
<th>RIGHTMOST</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k-a-[{يَا-واءطا}-ا]</td>
<td></td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. k-a-[{يَا-واءطا}-ا</td>
<td>*!</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The mobility of OMs arise because they are not lexically specified for prefix or suffix status; their position in the verb is derived from constraints on their prosodic incorporation – either as an affixal enclitic due to RIGHTMOST or as an internal clitic based on tone requirements of the stem. OMs are uniquely mobile within the Moro verb. Other high-toned affixes are lexically specified for position, whereas the other verbal clitics are low-toned, and cannot be displaced (see §5 for an analysis).
In conclusion, the ranking for default tone is MAX-IO(H), MSTEM-H, ALIGN (H,L) >> DEP-IO(H) >> RIGHTMOST. The OM is realized as a prefix i) if it is high-toned and ii) if its high tone can satisfy the default tone prosodic requirements of the macrostem constituent.

4.3. Analysis of melodic tone and OM suffixes. We previously noted that there are two basic kinds of melodic tone patterns realized within the inflectional stem. The proximal imperative in (32a) requires a H tone on every tone-bearing unit in the stem. In contrast, the other forms (32b-c) ban H tone on the macrostem, with H tone appearing only on inflectional stem-specific affixes.

(32)

\[
\begin{align*}
\text{a. proximal/itive imperative} & \quad [\{HH\}-H] & & [\{v\ddot{a}l\ddot{e}d\}-\ddot{o}] \\
\text{b. perfective} & \quad [\{LL\}-H] & & k-a-[\{v\ddot{a}l\ddot{e}d\}-\ddot{o}] \\
\text{c. distal/ventive imperfective} & \quad [H-\{LL\}-H] & & k-\dot{a}-[\{v\ddot{a}l\ddot{e}d\}-\ddot{o}] \\
\text{d. distal/ventive imperative} & \quad [\{LL\}-L] & & [\{v\ddot{a}l\ddot{e}d\}-a]
\end{align*}
\]

Since each aspect/mood introduces a different tone pattern even if the aspect/mood suffixes are identical, we assume that each aspect/mood construction is associated with a distinct co-phonology regulating the appearance of H tone within the inflectional stem. This is the equivalent in a rule-based framework of specific rules of tone assignment associated with specific tenses. We adopt the following additional constraints:

(33)

\[
\begin{align*}
*H_{\text{MSTEM}} & & \text{No H tone within macrostem} \\
\text{SPECIFY(H)} & & \text{Every TBU must bear H tone} \\
\text{IDENT-OI(H)} & & \text{If mora } x \text{ bears H tone in the output, then the input correspondent of } x \text{ bears H tone.}
\end{align*}
\]

For the proximal imperative, we assume a suffix /–ô/ and a constraint SPECIFY(H) which conditions spreading of H tone from the suffix vowel to the left edge of the inflectional stem. This constraint outranks IDENT-OI(H), a general faithfulness constraint against H association lines not present in the input. We surmise that spreading is involved due to the absence of
downstep, as discussed in section 3.3. For the other verb forms, a general constraint against H tone in the macrostem is ranked over MSTEM-H, the constraint that would normally place H tone on the macrostem. The remainder of the rankings are the same as for the default tone forms.

a. proximal imperative \{[HH]-H\} \text{SPECIFY(H)} >> \text{IDENT-OI(H)}

b. perfective \{[LL]-H\} *H_{\text{Mstem}} >> \text{MSTEM-H}

c. distal imperfective \{H-[LL]-H\} *H_{\text{Mstem}} >> \text{MSTEM-H}

d. distal imperative \{[LL]-L\} *H_{\text{Mstem}} >> \text{MSTEM-H}

These particular morphologically-conditioned rankings interact with the master ranking of constraints already established, the partial ranking of constraints to which cophonologies conform (Antilla 2002, Inkelas & Zoll 2007). So, although *H_{\text{Mstem}} >> \text{MSTEM-H} for (34b-d), \text{MSTEM-H} is still ranked above \text{DEF-IO(H)} and \text{RIGHTMOST}. We follow Antilla (2009) in adopting the view that constraints may be indexed for general morphological domains such as stem.

The tableau below demonstrates how the ranking in (35b) for the perfective prevents H from associating within the macrostem; we do not show the \text{AL(H,L)}_{\text{STEM}} constraint as it plays no role in this case, and must be ranked below *H_{\text{Mstem}}. The final vowel /-ó/ is underlyingly associated with a H tone:

\text{(34) Perfective: *H_{\text{Mstem}} >> \text{MSTEM-H}}

<table>
<thead>
<tr>
<th>/k-a-vəleð-ó/</th>
<th>*H_{\text{MSTEM}}</th>
<th>MSTEM-H</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. k-a-[vəleð]-ó</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. k-a-[vóléð]-ó</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

As melodic tone patterns are assigned within the inflectional stem, if high-toned OMs occurred within the macrostem, their H tone would conflict with the rankings that determine melodic tone. Melodic tone patterns that require a low-toned macrostem are in conflict with the H tone of the OMs. The iterative prefix, which can appear with H tone in the default verbs stems, fails to appear with high tone in the forms in (34b-d), ex. perfective \textit{k-a-vaf-fərleð-ó} ‘he pulled (iter.)’. The same behavior would be expected of an OM prefix, so hypothetical */k-a-pé-vəleð-ó/ should be realized as *[kənəvəleðó], where the OM occurs with no high tone, as shown in (35):
This would require the OM to lose its H tone in order to satisfy the melodic tone requirements. There is therefore no benefit to the OM being a prefix with a melodic tone pattern that bans H tone in the macrostem. It does not assist the realization of the all-low tone pattern required by this ranking, and the OM would lose its own tone if it were to do so.

The actual output is an OM suffix that preserves its H tone. It is better to realize the OM as a suffix than for it to lose its tone. The OM cannot meet the general prosodic requirement of the macrostem (providing it with an initial H tone), so suffix realization, which does not interfere with melodic tone, is preferred. This form also better satisfies RIGHTMOST, although due to its lower ranking, it does not play a decisive role in this form.¹⁶

The same analysis would be applied to the distal imperfective, which, in addition to the L-H tone pattern has a prefix -á, and to the distal imperative, which is marked by a final toneless suffix -a and is all low-toned. Appearing as a suffix allows the OM to maintain its H tone, as it would be outside the domain of melodic tone assignment. The main ranking is the same as for default tone: MAX-IO(H), MSTEM-H, ALIGN (H,L) >> DEP-IO(H) >> RIGHTMOST. The difference between default and melodic tone is captured by the position of the constraint *H_{MSTEM}, which is ranked above MSTEM-H for melodic tone, but below it for default tone.

The proximal imperative has a melodic pattern of H-H, achieved by spreading H across the stem as discussed above. This is modeled by the constraint ranking SPECIFY(H) >> IDENT-OI(H) slotted within the main constraint ranking: MAX-IO(H), MSTEM-H, ALIGN (H,L) >> DEP-IO(H)
RIGHTMOST. In particular, spreading of H is preferred to inserting H, so DEP-IO(H) must outrank IDENT-OI(H). The inclusion of an OM prefix with H tone would appear to assist in the realization of the H-H tone pattern. But, if an OM appeared as a prefix, it would introduce a separate autosegmental H tone, but would not assist in the realization of the tone pattern, which can be effectuated by spreading the H tone. The same number of faithfulness violations occurs regardless of the presence of an OM prefix. RIGHTMOST would therefore favor candidate (37c) with a suffix. The numerical subscripts in (37) represent the distinction between the tone of the OM and the tone spread from the aspect vowel.

(37)

<table>
<thead>
<tr>
<th></th>
<th>DEP-IO(H)</th>
<th>SPECIFY(H)</th>
<th>IDENT-OI(H)</th>
<th>RIGHTMOST</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. [{ŋə, -vəleð}-ð₂]</td>
<td><img src="#" alt="**!" /></td>
<td><img src="#" alt="**!" /></td>
<td><img src="#" alt="**" /></td>
<td><img src="#" alt="*" /></td>
</tr>
<tr>
<td>b. [{ŋə, -v5, lɛ, ʊ}-ð₂]</td>
<td><img src="#" alt="**" /></td>
<td><img src="#" alt="**" /></td>
<td><img src="#" alt="*!" /></td>
<td></td>
</tr>
<tr>
<td>c. [{v5, lɛ, ʊ}-ð₂]-pê</td>
<td><img src="#" alt="**" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This section has demonstrated that the high tone of the OM as a prefix conflicts with, or fails to contribute to, melodic tone realization requirements. The OM is therefore realized as an adjoined clitic outside the tone interaction domain, respecting the adjunction constraint for that position. In contrast, default tone is not subject to the same constraints on surface realization. There is a requirement of a H tone left-aligned in the macrostem, which the OM prefix satisfies. We conclude that the realization of the OM as a prefix or suffix is determined by phonology — the tone properties of the OM and the stem to which it attaches. This analysis makes two further predictions. First, if an OM is low-toned, it should surface as a suffix even with verb forms exhibiting default tone, because it cannot provide a H tone for the macrostem. Second, if there are two OMs, only one should appear as a prefix, since only one OM is needed to satisfy the macrostem H tone requirement. Both these predictions are true, and we explore them in the next section.

5. **More evidence for the role of tone: Non-mobile OMs.** The OMs we have examined so far all alternate between prefix and suffix depending on default or melodic tone, and they are
all high-toned. However, some OMs do not alternate at all, and when there are two OMs, only one can appear as a prefix; the other appears in the enclitic position.

There are three cases of non-alternation that we consider in this section. The first non-alternating OM is exceptional because of its tone. As pointed out in the introduction in example (3), the 3pl marker –lo is low-toned, and consistently appears as a suffix. In addition, the two 1pl forms in the OM paradigm show split behavior. They are exclusively suffixes in verb forms with melodic tone, but are split between a prefix and a suffix in verb forms with default tone:

<table>
<thead>
<tr>
<th></th>
<th>Precise (suffix OM)</th>
<th>Proximal imperfective (prefix OM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1EX.PL</td>
<td>k-a-vəleð-álahnda</td>
<td>k-a-nó-vəleð-álánda</td>
</tr>
<tr>
<td>1IN.PL</td>
<td>k-a-vəleð-ó-nídr</td>
<td>k-á-nída-vəleð-a-r</td>
</tr>
<tr>
<td>3PL</td>
<td>k-a-vəleð-ó-lo</td>
<td>k-a-vóléð-a-lo</td>
</tr>
</tbody>
</table>

While the 1PL forms bear H tone, they possess properties distinct from other OMs. In the case of the 1st exclusive plural OM, it is a trisyllabic affix, and in the case of the 1st inclusive plural OM, it is actually polymorphemic, with the second morpheme low-toned. This section demonstrates that the tonal analysis of mobile OMs presented in the previous section not only can accommodate these patterns, but in fact predicts the patterns of these OMs. We take this result to be a strong argument for the analysis of OM mobility based on the distribution of tone within the verb.

5.1. **Non-alternating 3PL.** Unlike all the other OMs, the 3PL does not bear H tone. It is also the only OM not to show variable positioning. Our analysis predicts this pattern. The low-toned OM is not specified with a H tone that can satisfy MSTEM-H for default tone cases, and it would incur a phonological faithfulness violation of DEP-IO if it were realized as a prefix, since a H tone would be inserted on it. In addition, realization as a prefix incurs a violation of RIGHTMOST. This is illustrated in (39) for the proximal imperfective verb form:
There is no phonological benefit to \( -lo \) being realized as a prefix, so it is realized in its unmarked position as an enclitic.

As for melodic tone, it might appear that the 3\( \text{PL} \) low-toned OM \( -lo \) could appear as a prefix, since it does not introduce H tone into the macrostem, which is a requirement of most melodic tone forms. But just like in the default tone cases, there is no benefit to the prefixal position of this OM because it does not bear H tone.

It is also clear that the 3\( \text{PL} \) \( -lo \) stands no chance of appearing as a prefix in the all H-toned proximal imperative form. It would either acquire H tone or fail to realize H tone in the inflectional stem, either way violating a higher-ranked constraint as well as RIGHTMOST:

Although \( -lo \) does differ from other OMs in that it can refer to objects and animals as well as humans, it is hard to see how this property prevents its realization as a prefix. Requiring that prefix OMs be specified as [+human], but suffix OMs do not seems like an ad hoc stipulation. In
contrast, the phonological analysis connects the behavior of –lo directly to its tone specification, which is the factor driving prefix/suffix status.

5.2. Split OMs. Turning now to the 1PL OMs, the 1IN.PL, tídr; is split in two in the prefix-inducing verb forms. There is evidence that tídr is actually composed of two affixes. The suffix –r appears in other verb forms in Moro to mark plurality, and never appears as a prefix. It can be added to 1DU to create 1PL (42b), and to imperative singulars to create imperative plurals (42d):

(42) a. álš-g-a-vóléð-a ‘we (IN.DU) are pulling’
b. álš-g-a-vóléð-a-r ‘we (IN.) are pulling’
c. vóléð-ó ‘pull (SG.)!’
d. vóléð-ó-r ‘pull (PL.)!’

Therefore, it is highly plausible that 1PL is marked by nd, the same marker found in 1dual, and a plural marker –r, in a similar fashion to the way subjects are marked in (42). The nd appears with epenthetic [ə] when a prefix, but with a final [a] when a suffix. The fact that only one marker is prefixed follows from the analysis developed so far. There is no benefit to having –r in the macrostem as it is not high-toned, and the nd satisfies the macrostem H requirement.

Now consider the affix –álánda, which is consistently a suffix. When it occurs in a default tone verb form, an extra pš- prefix appears. This prefix is the same as the 1SG OM prefix. Given this similarity, we interpret the pš- as a general 1st person prefix, rather than 1st singular. With default tone verb forms, it appears in the prefix position and –álánda is used in addition to differentiate it from 1SG. The use of both are unnecessary with melodic tone forms, and only –álánda appears. Two explanations are possible for why –álánda cannot occur as a prefix itself. First, álánda begins with a vowel-initial light syllable with high tone. If such a form appeared at the left edge of the macrostem, this would cause a conflict, as high tone in light V-initial syllables is dispreferred at the macrostem left edge, as observed with vowel initial roots in (12). Second, –álánda is too long to be a prefix. Most prefixes in Moro are momoraic (C-, V-, CV-) or maximally bimoraic (CVC-, VCV-). A prefix of this size (-VCVCCV) is otherwise unattested. Whichever explanation holds, –álánda fails to meet the prosodic criterion to be a prefix. Instead, another H-tone bearing monomoraic prefix is co-opted to appear in the prefix position instead.
This completes the analysis of the object markers marking all eight person/number combinations in Moro. In the following section, we turn to double object markers. We demonstrate how the analysis so far developed naturally extends to these cases, too.

5.3. **Double object markers.** In addition to the single object markers so far discussed, Moro allows double object marking constructions, which arise with ditransitive and applicativized verbs. The double object constructions show two relevant properties: 1) only one object marker at a time may occur in prefix position and 2) object markers are ordered in a linear fashion according to person/number. The first property follows from the phonological analysis so far developed. The second property is independent of that analysis, and follows from the incorporation of the person hierarchy as an ordering effect.

Double object markers both appear on the verb, and appear in the suffix position with melodic tone verb forms. For double object combinations, the order is 1SG > {2SG ~ 1DU/PL} > 3SG > 3PL. This requirement overrides any ordering with respect to semantic role, resulting in ambiguity:

(43)  

<table>
<thead>
<tr>
<th></th>
<th>a. 1SG &gt; 3SG</th>
<th>k-a-naṭʃ-ŋa-ŋo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SM.CL-MAIN-give-PFV-1SGOM-3SGOM</td>
<td>‘s/he gave me to her/him’ or ‘s/he gave her/him to me’</td>
</tr>
<tr>
<td>b. 1SG &gt; 2SG</td>
<td>k-a-naṭʃ-ŋa-ŋa-ŋo</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SM.CL-MAIN-give-PFV-1SGOM-2SGOM-ŋo18</td>
<td>‘s/he gave me to you’ or ‘s/he gave you to me’</td>
</tr>
</tbody>
</table>

The order 1 > 2 > 3 follows the Person Hierarchy (Silverstein 1976), a hierarchy that is recognized for a variety of languages for a range of phenomena, where 1,2 > 3. Clitic order in Romance (Perlmutter 1971, Bonet 1995, Heap 2005, Nevins 2007) and Arabic (Fassi Fehri 1993:104) also rely on the person hierarchy, although clitic order may also intersect with the person-case constraint. African languages such as Kera (Ebert 1979), Shambala (Duranti 1979) and Haya (Hyman & Duranti 1982) show some evidence for ordering between 3rd person and 1st person object markers, whereby the 1st person marker is closer to the verb stem, but the
ordering is also connected to semantic role. The person hierarchy as an effect on linear order is attested cross-linguistically.

The order of object markers in default tone stems is also determined by the person hierarchy, but only one prefix is allowed, the one highest on the person hierarchy. The other object marker appears as a suffix following the same linear order. Compare the melodic tone sequences in (44a,b), with those with default tone in (44c,d):

\[
\begin{align*}
\text{(44) } & \quad \text{Perfective} & \quad \text{Proximal imperfective} \\
a. & \quad k-a-naʧ-\text-d ني-\text-a-ٮ & \quad k-\text-a-ني-ناʧ-ا-ٮ \\
& \quad \text{CL.SM-give-PFV-1SGOM-3SGOM} & \quad \text{CL.SM-Main-1SGOM-give-IMPV-3SGOM} \\
& \quad \text{‘s/he gave me to her/him’} & \quad \text{‘s/he is about to give me to her/him’} \\
& \quad \text{‘s/he gave her/him to me’} & \quad \text{‘s/he is about to give her/him’} \\
b. & \quad k-a-naʧ-\text-d ند-ني & \quad k-\text-a-ني-ناʧ-ا-ٮ \\
& \quad \text{CL.SM-give-PFV-1IN.PL-PL-3SGOM} & \quad \text{CL.SM-Main-1IN.PL-give-IMPV-1IN.PL-PL-3SGOM} \\
& \quad \text{‘s/he gave us all to her/him’} & \quad \text{‘s/he is about to give us all to her/him’} \\
& \quad \text{‘s/he gave her/him to us all’} & \quad \text{‘s/he is about to give her/him to us all’}
\end{align*}
\]

The fact that only one object marker appears as a prefix follows from the analysis already developed. Only one high-toned OM satisfies M-STEM-H and Al(H,L). Fronting two would violate Al(H,L) and RIGHTMOST. If an OM lost its H tone to avoid an Al(H,L) violation, as in (45c), this would still incur a MAX violation.

\[
\begin{array}{|c|c|c|c|c|}
\hline
/k-a-naʧ-a \text{-ني-ٮ}/ & \text{MAX-IO-H} & \text{MSTEM-H} & \text{AL(H,L)} & \text{DEP-IO(H)} & \text{RIGHTMOST} \\
\hline
\text{a. k-a-} & \text{[} & \text{ني-ناʧ} & -\text{ا-ٮ} & & 5 \\
\hline
\text{b. k-} & \text{[} & \text{ني-ني-ناʧ} & -\text{ا-ٮ} & & 2 \\
\hline
\text{c. k-} & \text{[} & \text{ني-ني-ناʧ} & -\text{ا-ٮ} & & 3 \\
\hline
\text{d. k-} & \text{[} & \text{nات} & \text{-ا-ني-ٮ} & & 1 \\
\hline
\end{array}
\]

The particular order of the OMs follows from the person hierarchy, and this can be applied either to the linear order of OMs outside the inflectional stem, or to the prefix-suffix combinations.
Those OMs that are higher on the person hierarchy must occur closer to the verb stem. Given the structure of the Moro verb, the macrostem OM position is hierarchically a more inner stem position than an OM enclitic. We do not develop an analysis of how the person hierarchy is incorporated formally here. Various proposals have been offered in the literature, ranging from alignment constraints (Curnow 1999) to particular feature geometry effects on person/number feature combinations (Harley & Ritter 2002, Heap 2005, Nevins 2007). These accounts provide formal methods of describing the restriction, but our goal here is simply to show that the phonological account predicts a single OM prefix with double object constructions.

In conclusion, double object constructions introduce ordering of OMs based on the person hierarchy. Independently of this restriction, only one prefix is allowed in default tone constructions. While this could be due to a templatic position that allows only a single affix, we show how it follows naturally from the tone-based analysis. Only a single H toned OM is needed to satisfy the prosodic default tone requirement; an additional OM incurs further constraint violations.

6. **Tone distribution determined by verb stem.** So far we have only analyzed tone assignment within the inflectional stem domain. Nevertheless, there are two cases in which tone is positioned or determined within the larger verb stem that we have not yet introduced. The first case concerns vowel-initial verb roots, which are subject to vowel hiatus that eliminates the OM’s tone-bearing unit. The second concerns two subordinate subject markers that impose their own tone restrictions on macrostem tone. We propose that the verb stem is associated with a different cophonology than that of the the inflectional stem, and that the verb is built up in a hierarchical cyclic fashion with different cophonologies at each stem level.

6.1 **Vowel-initial verb stems with OMs.** In Moro, vowel hiatus typically results in the deletion of the first vowel. Thus, when a vowel-final OM is attached as a prefix before a vowel-initial root or macrostem prefix, the vowel of the OM is deleted. The H tone which would have appeared on the vowel of the OM is “orphaned” and forced to appear elsewhere. According to the Stranded Tone Principle (Clements & Ford 1979), tone should be recuperated on the vowel that triggered deletion. However, in Moro, it appears on the vowel in the preceding syllable. Consider the examples in (46). In (46a), the H tone of the OM appears on the preceding main
clause marker $a$, and in (46b) it appears on the subordinate subject marker $\text{n}a$- (raised to $[\text{n}a]$ due to vowel harmony in the surface form).

\begin{align*}
(46) & \quad \text{a.} \quad /k-a-\text{n}é-abatʃ-a/ \to [k-á-\text{ɲ}-abatʃ-a] \\
& \quad \text{CL-MAIN-1SG.OM-lift-IMPV} \quad \text{‘s/he is about to lift me’} \\
& \quad \text{b.} \quad /nə-\text{n}a-\text{n}ó-aləŋ-ət-e/ \to [nə-\text{ɲ}á-\text{ɲ}-\text{w}-aləŋ-ət-i] \\
& \quad \text{COMP-2PL-3SG.OM-sing-APPL-PROX.CONSEC} \quad \text{‘then you all sang to him’}
\end{align*}

The H is associated with the OM prefix outside of the macrostem in these cases, in seeming violation of MSTEM-H.

One reason for the shift leftwards could be the avoidance of H tone on a root-initial onsetless light syllable, as described in section 3.1. There is evidence against this analysis: heavy vowel-initial syllables, which generally can bear H tone, also cause leftward shift, e.g. $k-\text{áff-a} \ ‘he is about to shoot’$ vs. $k-\text{á}-\text{ɲ}-\text{aff-a} \ ‘he is about to shoot me.’$

The leftwards shift of the H tone of the OM is therefore due to different pressure than phonotactic avoidance of a H tone on the initial syllable of the root. Jenks & Rose (2011) attribute the leftward shift to a constraint, MORPHEME DEPENDENCY, which restricts tone originating on a different input morpheme from appearing within the macrostem. Another interpretation of this restriction is that tone cannot appear on a morpheme that is closer to the root than its point of origin, a type of cyclic effect.

Crucially, the leftwards shift of H does not always occur. The H tone of the OM will appear within the macrostem if there is no available morpheme to its left, such as when the prefix to the left already bears H tone. In (47a), hiatus occurs between the OM $\text{n}é$- and the verb root $-\text{aləŋ}$- in the subordinate verb. The vowel of the OM is deleted, and the H tone appears to the left on the subject marker $a$-, which is low-toned. Note that the applicative marker $-\text{ət}$ raises all vowels. In (47b), the subject marker is high-toned, and so in this case, the high tone of the OM cannot appear to the left on the subject marker. It appears instead on the first vowel of the root, and downstep occurs between the H tone of the subject marker, which is in the verb stem, and the H tone of the OM, which is in the macrostem/inflectional stem.
These examples illustrate that H tone is not deleted, but will appear on the macrostem if there are no positions to the left. Therefore, we maintain that the OM is fronted internal to the macrostem, even though the final position of its tone may depend on availability in the larger verb stem.

Given the examples above, the position of the OM must be fixed at the level of the inflectional stem. The addition of other prefixes interacts with the tone of the inflectional stem in predictable ways. If the adjacent prefix is H toned, it triggers downstep on the orphaned OM tone. If the adjacent prefix does not bear H tone, it can then provide a new host syllable for orphaned OM tones. This leftward movement is motivated by morpheme dependency, which prohibits orphaned tones from attaching inside the macrostem. When the prefix preceding the OM is H toned, this constraint is overridden due to the unavailability of a new host for the orphaned H tone. This analysis assumes that at the verb stem level, the constraint MSTEM-H is ranked lower than MORPHME DEPENDENCY, and H tone shifts to the left if there is an available position, but will not delete due to high-ranked MAX-IO(H).

### 6.2. Subject marker-conditioned tone patterns

The behavior of subject markers in subordinate verb forms provides another example of how tone requirements at the level of the verb stem can override the requirements of the inflectional stem, but do not alter the position of the OMs. Consider the following consecutive perfective paradigm, with the structure COMP-SM-leave-CONS.PFV. The verb tað is a H-H verb, and so spreads its H tone onto the aspect suffix /-e/.

\[
\begin{array}{lll}
1SG & ìgàʧâǹó & n-e-táð-é & 'I got mad and left it' \\
2SG & ágàʧâǹó & n-a-táð-é & 'you got mad and left it' \\
3SG & kàʧâǹó & n-ðì-táð-é & 'he got mad and left it' \\
1DU & ìlàgàʧâǹó & n-àlø-táð-é & 'we two got mad and left it' \\
\end{array}
\]
The 1EX.PL and the 3PL both have low-toned macrostems in the subordinate verb. The 1EX.PL subordinate form differs from the 2PL only by the tone pattern on the inflectional stem. This is consistent across all subordinate verb stems. However, despite the lack of H tone in the macrostem, the OM is still a prefix in these forms, and still bears H tone. In fact, the presence of an OM renders the 1EX.PL and 2PL homophonous, since the 3SG OM –ŋó carries the macrostem H tone instead of the verb root in the case of 2PL in (49).

This indicates that these particular subject markers require a specific melodic tone pattern: no H tone in the macrostem. However, this requirement cannot affect either the position of the OM nor its H tone. Only the inserted H tone of the macrostem fails to appear. In addition, H tones of other verb stem morphemes are unaffected, such as the complementizer or aspect suffixes. Consider the distinction between consecutive imperfective 2PL ʔr̥-ná-w’át-s’ó ‘..and then you all are sewing’ versus 1EX.PL ʔr̥-na-wat-s’ó ‘..and then we (not you) are sewing’. The underlying H tones of the complementizer and aspect suffix are not deleted in the latter form. There is only a failure for the macrostem default H to appear.

As above, we will not present a formal analysis of these data for lack of space. The basic idea is that the 1EX.PL and 3PL subject markers, which bans H tone within the verb stem, are associated with alternate cophonologies. Specifically, the same ranking is assumed as for other default verb forms, with the exception that DEP-IO(H) >> MSTEM-H. This ranking suppresses default tone because it is inserted, but allows underlying H tones to surface. As candidates with prefixal OMs do not require H tone insertion, they satisfy MSTEM-H in addition to AL(H,L), and thus still optimize the tonal shape of the macrostem.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1IN.PL</td>
<td>Álāɡatʃ’aránó</td>
<td>n-al-táː-ð-ɾ</td>
<td>‘we all got mad and left it’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1EX.PL</td>
<td>ɲáɡatʃ’ánó</td>
<td>nə-ŋa-tað-e</td>
<td>‘we (not you) got mad and left it’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2PL</td>
<td>ɲáɡatʃ’ánó</td>
<td>nə-ŋa-táː-é</td>
<td>‘you all got mad and left it’</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3PL</td>
<td>ləfʃ’ánó</td>
<td>lə-tað-e</td>
<td>‘they got mad and left it’</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In summary, these two cases show that there can be additional tone effects at the level of the verb stem, further motivating a domain distinction that was already established on independent grounds in §3. In both cases, the position of the OM as a prefix or suffix was shown to be solely dependent on the tonal properties of the inflectional stem.

7. **Phonological Effects on Affix Order.** We have established that tone is the deciding factor in the position of the OM, a case of phonology determining affix position. We now explore the ramifications of this conclusion for the architecture of grammar, and we briefly discuss two cases that bear some similarity to Moro.

As mentioned in the introduction, the notion that phonology can determine morphological order is familiar from some approaches to infixation. In the standard OT analysis of infixation, phonological constraints such as NO Coda can dictate the position of affixes, pushing prefixes or suffixes within a stem. Yu (2007a,b) argues against this P >> M “displacement theory” of infixes (McCarthy & Prince 1993) and in favor of generalized phonological subcategorization, in which infixes subcategorize for prosodic constituents. Such a theory is argued to constrain the interaction between phonology and morphology and maintains a ‘morphology precedes phonology’ approach. Paster also adopts this model for the behavior of phonologically conditioned suppletive allomorphy (2006, 2009) and apparent cases of phonologically conditioned affix order (2005).

With respect to variable or mobile affixes that shift between prefix and suffix, there are also two distinct analytical approaches. Kim (2008, 2010) argues that phonological constraints outrank morphological constraints for Huave mobile affixes, and Wolf (2008) also argues for a P >> M approach for mobile affixes. In contrast, Stump (1993) and Paster (2006, 2009), favor subcategorization approaches to morphological position, and suggest that mobile affixes have allomorphs with distinct subcategorization frames.

Besides Moro, two cases of phonology dictating prefix or suffix position are reported in the literature: Huave, mentioned in the introduction, and Afar. Both involve affixes being variable in accordance with syllable structure and initial segments of the stem. We provide a brief outline of each, and discuss why they do constitute legitimate cases. We conclude by arguing that variable affixation can be determined by phonology, and by extension, the Moro case of OM placement according to tone. We then speculate on the rarity of such cases.
7.1 Huave Mobile Affixes. Kim (2008, 2010) prevents an analysis of San Francisco del Mar Huave mobile affixes. Huave has consonantal mobile affixes that are positioned as prefixes or suffixes for phonological reasons: to avoid epenthesis, regardless of the morpho-syntactic properties of the stem. Similar cases were also discussed in Noyer (1994) for San Mateo del Mar Huave. Some examples of mono-consonantal affixes are shown below for four such affixes: stative -n-, completive -t-, subordinate -m-, 2nd intransitive -r-

<table>
<thead>
<tr>
<th>(50)</th>
<th>Prefixing stems</th>
<th>Suffixing stems</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. n-[a-kants]</td>
<td>‘red’</td>
<td>[pal-a]-n ‘closed’</td>
</tr>
<tr>
<td>b. t-[u-ty]</td>
<td>‘s/he ate’ (itr.)</td>
<td>[mojk-o]-t ‘s/he lay face</td>
</tr>
<tr>
<td>c. m-[u-ty]</td>
<td>‘(that) s/he eats’ (itr.)</td>
<td>[mojk-o]-m ‘(that) s/he lies</td>
</tr>
<tr>
<td>d. i-r-[u-ty]</td>
<td>‘you eat’ (itr.)</td>
<td>i-[mojk-o-r] ‘you (sg.) lie</td>
</tr>
<tr>
<td>e. t-[e-r-u-ty]</td>
<td>‘you ate’ (itr.)</td>
<td>t-[e-moyk-o-r] ‘you (sg.) lay</td>
</tr>
<tr>
<td>f. m-[e-r-u-ty]</td>
<td>‘(that) you eat’ (itr.)</td>
<td>m-[e-moyk-o-r] ‘(that) you (sg.) lie</td>
</tr>
</tbody>
</table>

Of particular interest are the forms in (53h) compared to (53k), in which the completive affix –t- is realized as a suffix following a vowel in (53h), but as a prefix, when the 2nd intransitive affix precedes it in (56k). The same 2I affix is itself mobile, being realized as a suffix in (53k), but as a prefix in (53e).

Kim argues that suffixation is the default pattern (generated by a constraint Align-R), but that the affixes will be shifted to prefix position to avoid consonant sequences and the creation of a complex coda. If the shift to prefix does not improve syllable structure, or if shift is not motivated by the phonotactics, then epenthesis occurs. A basic case of epenthesis is shown in (51) in which the stem is consonant-initial and consonant-final. If the affix is realized as a prefix,
a complex onset will result, and if it is realized as a suffix, a complex coda will result. Either of these options must be fixed by epenthesis. Suffix is the default, preferred position, so the affix appears as a suffix to satisfy Align-R, and epenthesis occurs between the final two consonants.

(51)

<table>
<thead>
<tr>
<th>[tarang] + s</th>
<th>*COMPLEX</th>
<th>DEP-IO</th>
<th>ALIGN-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. tarangs</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. tarangas</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. starang</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. satarang</td>
<td></td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

In contrast, if the stem is vowel-initial and consonant-final, then the affix can be shifted to prefix position, and the creation of a complex coda and epenthesis are both avoided.

(52)

<table>
<thead>
<tr>
<th>[arang] + m</th>
<th>*COMPLEX</th>
<th>DEP-IO</th>
<th>ALIGN-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. arangm</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. arangam</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>c. marang</td>
<td></td>
<td></td>
<td>*</td>
</tr>
</tbody>
</table>

If the stem is vowel-initial and vowel-final, then a suffix occurs, since in either position, complex codas and onsets are not produced. Align-R ensures that a suffix is chosen.

Kim argues that this analysis is preferable to one that relies on subcategorization. A subcategorization analysis would need at least two distinct subcategorization frames for a single affix (Stump 2003) or for two separate affixes (Paster 2009). For Huave, a prefix would subcategorize for a vowel-initial stem, whereas the suffix would be the elsewhere case (Kim 2010). The fact that both affixes are segmentally identical, have the same meaning, and appear in complementary environments is a coincidence in the subcategorization analysis. Kim argues that this approach also misses the generalization that affix mobility optimizes syllable structure.

Paster’s (2009) solution to Huave is to propose that it has fixed C and V positions, but segments are allowed to ‘float’ and associate from left-to-right within subscribed levels. There is
no independent motivation for such a proposal except to avoid a phonological analysis of affix ordering. Kim notes that her analysis directly specifies the morphological location of the affixes within subscribed morphological levels. It is only within these levels that there is phonologically-determined prefix or suffix positioning. By constraining the creation of these positions morphologically, such an analysis avoids criticisms of overgeneration leveled against P >> M.

7.2 **Afar mobile affixes.** Afar presents another example of mobile affixes, as analyzed in Fulmer (1991) and Rucart (2006). Afar has two main verb types, labeled Class I and Class II (Parker & Hayward 1985), and several ‘mobile affixes’ which appear as either prefixes or suffixes. Class I verbs, which condition prefixes, begin with a vowel /e o i u/, while Class II verbs, which condition suffixes, begin with a consonant or /a/. This pattern is shown in the following chart of subject marking in the perfect (Bliese 1981):

<table>
<thead>
<tr>
<th></th>
<th>Perfect</th>
<th>Class I</th>
<th>‘know’</th>
<th>Class II</th>
<th>‘open’</th>
<th>‘close’</th>
</tr>
</thead>
<tbody>
<tr>
<td>1sg</td>
<td></td>
<td>edeq-e</td>
<td></td>
<td>fak-e</td>
<td>alif-e</td>
<td></td>
</tr>
<tr>
<td>2sg, 3sgf</td>
<td></td>
<td>t-edeq-e</td>
<td></td>
<td>fak-t-e</td>
<td>alif-t-e</td>
<td></td>
</tr>
<tr>
<td>3sgm</td>
<td></td>
<td>j-edeq-e</td>
<td></td>
<td>fak-e</td>
<td>alif-e</td>
<td></td>
</tr>
<tr>
<td>1pl</td>
<td></td>
<td>n-edeq-e</td>
<td></td>
<td>fak-n-e</td>
<td>alif-n-e</td>
<td></td>
</tr>
<tr>
<td>2pl</td>
<td></td>
<td>t-edeq-e-n-i</td>
<td></td>
<td>fak-t-e-n-i</td>
<td>alif-t-e-n-i</td>
<td></td>
</tr>
<tr>
<td>3pl</td>
<td></td>
<td>j-edeq-e-n-i</td>
<td></td>
<td>fak-e-n-i</td>
<td>alif-e-n-i</td>
<td></td>
</tr>
</tbody>
</table>

In addition to the subject markers, the causative (/s/) and benefactive (/t/) and passive (/m/) markers, show similar dual positions. When suffixes they are realized as –IC with an epenthetic vowel (or –uC after a stem /u/) : ex. bare ‘I learned’ → benefactive bar-it-e ‘I/he learned’ and causative bar-is-e ‘I/he taught’. In the Aussa dialect, the epenthetic vowel is not used. Prefixes have more allomorphs. They are generally realized as VC- with a copy of the stem vowel. The causative is Vjs-, Vs- or Vj-, the passive is -Vm (with nasal assimilation) and the benefactive is Vtt-, Vss-, VC or Vdd-, with additional stem gemination possible. For example, from okme ‘I ate’ → passive on-komm-e ‘it was eaten’ and benfactive ott-okomm-e ‘he/it ate for’.
The phonological aspect of their distribution resembles that of Huave in that prefixes appear with stems that are vowel-initial. Unlike Huave, in Afar stems that begin with the vowel [a] do not trigger prefixation. Otherwise, with consonant-initial and [a]-initial stems, suffixes occur. Fulmer (1991) proposes that the affixes are basically suffixes that are copied and moved to prefix position according to the consonant/vowel status of the initial root consonant. She argues that /a/ is an underspecified vowel and due to the lack of vowel features, it escapes being interpreted as a vowel for the prefix/suffix distinction. However, Bliese (1973) argues that the a-initial stems were historically Ɂ-initial, in which case the division would have been based on a strict consonant-initial vs. vowel-initial division.

Today, however, the system is not so clear-cut. In fact, Afar is undergoing further change. The division of Class I/Class II is no longer perfectly divided based on initial vowel. While all a-initial verbs are suffixing, other vowel-initial verbs are also suffixing, as a verb count based on the Parker & Hayward (1985) dictionary reveals:

<table>
<thead>
<tr>
<th>54</th>
<th>initial root V</th>
<th>Class I</th>
<th>Class II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>0</td>
<td>119</td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>76</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>o</td>
<td>27</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>i</td>
<td>126</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>u</td>
<td>77</td>
<td>21</td>
<td></td>
</tr>
</tbody>
</table>

Dialectal evidence (Bliese 1973) also suggests that Afar is undergoing a shift towards using suffixes, even with verbs that are vowel-initial.

Although Afar has the historical hallmarks of a phonologically-dependent mobile affix system, language change has caused a breakdown in the consonant vs. vowel conditioning distinction. The shift towards suffixation has further caused the Class I/II distinction to be morphologized.

7.3. **RARE BUT ATTESTED.** The variable affix cases of Huave, Afar and Moro share certain traits. First, they all appear to favor suffixation as the default case. Prefixation occurs for phonological reasons: to satisfy H tone requirements in Moro and to satisfy syllable structure requirements in
Huave and Afar. Second, the mobile affixes constitute only a subset of verbal affixes which share a common phonological make-up (a single consonant for Huave and Afar (with epenthetic vowels); a single CV syllable with H tone for Moro). Moreover, their phonological make-up connects directly with the phonological constraints on their realization. Third, they are constrained morphologically. The Afar morphemes are subject markers and ‘extension’ markers, appearing closest to the verb root. In Huave, Kim shows how the morphemes are restricted to two inner morphological levels. In Moro, the mobile affixes are object markers that attach to the inner macrostem. Their positions do not break-up morphemes, as in the case of infixation or metathesis. They do not ‘float’ in the sense of featural morphemes, being able to attach to different segments. Rather, their basic position adjacent to the verb is determined by morpho-syntax, while the shift to the prefixal position is due to the phonology of a morphologically delimited domain. In fact, such an analysis may not be at odds with Paster (2009)’s claim that affix placement can be affected by phonology via subcategorization for phonological elements, but this will produce only local effects (e.g. infix placement) rather than radical ‘reshuffling’ of multiple morphemes for phonological well-formedness. While mobile affixes are not strictly local in terms of adjacency, they are hierarchically local in the context of the morphological structure of the verb stem. That is, whether an affix associates as a prefix or suffix, it is still positioned at the edge of a particular domain, and ordered linearly in the same fashion with respect to the root and other affixes. For example, the Afar extension markers suffix to the verb root, followed by the subject markers. When they are prefixes, the subject markers precede them. In Huave, Kim shows how the verb is structured in layers, like the Moro verb, and the mobile affixes attach within prescribed layers.

As to the reliance on tone as a phonological condition, this is more unexpected, since tone systems tend to be variable in lexical specification and distribution. However, note that default H tone in the Moro verb system, which conditions prefixation, is predictable in position and appearance, in a manner more similar to stress or pitch accent. As infixes can depend on stress for their position, it is not inconceivable that consistent tone in a predictable position could also motivate infixation. However, a language must have all of the necessary conditions in place in order for affix mobility to optimize prosodic structure in this way.

Although rare, mobile affixes are attested in the world’s languages, and are observed in languages belonging to different language families. Analyses seeking to explain them in their
own right focus have focused on the role of phonology. Analyses that seek to explain them away because they do not fit a unified theory of phonology/morphology interaction prove unexplanatory. Our position is that it is possible for phonology to constrain morpheme position, and we have attempted to construct the best possible analysis of this interaction, using a P >> M analysis, where M constraints are construed as morpho-syntactic, formulated with reference to morpho-syntactic (verb stem/verb phrase) domains. This is in line with other approaches to rare phenomena in language, as outlined in Harris (2010). Harris argues that many examples of rare morpho-syntactic structures are the result of a complex combination of changes and conditions. Although uncommon, such structures are attested, and often endure, and grammatical analyses need to accommodate them.

Affixes generally appear in particular positions on a consistent basis. While it is possible that the prefix OM position in Moro may have historically arisen due to morpho-syntactic reasons, such as an auxiliary that may have eroded with the one non-dependent verb form (proximal imperfective), the current motivation for alternate positions is phonological. The different OM positions now serve to demarcate the boundaries of morphological domains within the verb. Related Kordofanian languages such as Otoro (Stevenson 2009) and Cwaya (Guest 1998) also show mobile positioning of person/number markers, but allow more than one affix to be prefixed. However, little is know about the tone systems of these languages. In Cwaya, suffixes do co-occur with the low-toned verb form (present), whereas prefixes co-occur with verb forms with lexical H tone (past and future), a similar type of distribution to Moro, but the available data only lists three verb form types. If these systems evolved from a different conditioning strategy, but the tone and the position of OMs is now used to mark prosodic constituents, we expect such cases to arise only under particular circumstances, and to be far from common.

8. CONCLUSION. In this paper we have presented novel data on the position of object markers in the Thetogovela dialect of Moro, an underdocumented Kordofanian language of Sudan. While we have shown that the positions of object markers in Moro as either prefixes or suffixes correlate with certain aspect/mood/deixis of verb forms, we argued that the positions do not follow from clearly generalizable morpho-syntactic characteristics of the verb forms. The positions do, however, neatly follow from the tonal properties of these particular verb forms. We analyze the object marker positions as following from restrictions on the distribution of tone. If a
verb form requires a particular melodic tone pattern, object markers are suffixes. On the other hand, if a verb form adopts a default, phonologically-predictable pattern, then object markers appear as prefixes. The tone property of the object markers themselves also dictated their appearance as prefixes. Only a single H toned object prefix is allowed, whereas low-toned and additional object markers appear as suffixes. Although such phonologically-determined patterns of affix position are rare in the world’s languages, the Moro case underscores the need to accept them as reality and incorporate them into the architecture of grammatical systems.

REFERENCES


BICKMORE, LEE. 2007. Stem Tone Melodies in Cilungu. SOAS Working Papers in Linguistics Vol. 15. 7-18


LEGENDRE, GÉRALDINE. 2000. Positioning Romanian clitis in PF: an Optimality-Theoretic analysis. 


MUTAKA, NGESSIMO AND LARRY HYMAN. 1990. Syllable and morpheme integrity in Kinande reduplication. _Phonology_ 7. 73-120.


PASTER, MARY. 2005. A survey of phonological affix order with special attention to Pulaar. 


**Endnotes**

1 Abbreviations: ASP=aspect; CL=noun class; COMP=complementizer; DU=dual; EX=exclusive; EXT=extension marker; IMPV=imperfective; PROG=progressive; ITER=iterative/durative; IN=inclusive; INST=instrumental; LOC=locative; OM=object marker; PL=plural; PFV=perfective; SG=singular; SM=subject marker.
The OM shifts vowel quality depending on position. Full vowels alternate with schwa in prefix position. The vowels /i e o u/ can reduce to schwa. We assume that the 1PL(IN.DU) alternation [nda] ~ [ndə] arises from underlying /nd/ realized as [nda] when followed by a consonant and as [ndə] in word-final position. This suffix appears as [ndə] when followed by another consonant-initial suffix: k-a-natʃ-ɔ-ndə-ŋo ‘s/he gave us to him / him to us’.

We consider only the markers in (8) for now. Three other OM categories will be analyzed in §5: 1IN.PL, 1EX.PL and 3PL.

Proximal forms involve location of the event/addressee close to the speaker, whereas distal forms involve location of the event/addressee at a distance from the speaker. Distance can also be interpreted as lack of emotional involvement in the event. In addition, proximal forms may convey movement away from the speaker (also known as itive), whereas distal can be used for movement towards the speaker (also known as ventive). The main perfective does not encode direction/location distinctions, but the consecutive perfective does. Conversely, the main imperfective does encode direction/location whereas the consecutive imperfective does not. See Dimmendaal (2009) for discussion of similar distinctions in Tima, a related language.

We assume that this is a separate prefix á- rather than a high tone that appears on the clause vowel a-. This is because in subject and non-subject extraction, clauses are marked with é- and ď- respectively rather than a-, except in distal imperfectives. In distal imperfectives, subject and non-subject extraction are not marked overtly on the verb, but are gleaned from context. We surmise this is due to vowel hiatus of the clause prefix and the distal imperfective prefix: /k-é-ą-voleđ-ő/ → [kávoleđő]. Vowel hiatus in Moro is resolved in favor of the second vowel if hiatus occurs outside the derived stem.

Dependent clause forms (subordinate, consecutive and negative) show different tone patterns dependent on person/number of the subject. Most forms show the standard default tone pattern, but 1pl excl and 3pl are low-toned regardless of root type. These forms are discussed in §6.

The only exception to this pattern is the addition of a H tone on the vowel preceding an OM suffix in verbs that are all low-toned: voleđ-a → [voleđa] ‘pull!’ but [voleđáné] ‘pull me!’ This H tone is not part of the tone melody, but appears on low-toned verbs in non-final phrase position.
For example, it is found with low-toned VC verbs if an object follows: /k-a-p-a/ → [kapa] ‘he carried’ but [kapá gola] ‘he carried the plate’.

9 Another way of marking iterative is /r/ infixed as a coda of the first syllable of the root, often used with vowel-initial roots, ex. kilîða ‘s/he is buying’ vs. kirliða ‘s/he is buying (iter.). Note that the /r/ creates a heavy syllable and so default H tone appears on the first syllable of the root rather than the second. The verb /vəlð/ preferentially uses both reduplication and /r/ infixation.

10 The aspect prefix /á-/, which marks distal imperfective, requires a melodic tone pattern with no H on the macrostem. For this independent reason, it never cooccurs with macrostem H tone. It also shows no tone interaction (downstep) with preceding H toned prefixes: égávəledó ‘I am about to pull over there’. This suggests that this prefix is not within the macrostem.

11 This verb form features the vowel-initial, heavy-syllabled root /-áff/. Because of vowel hiatus between the clause-marking prefix /a-/ and the root, the clause-marking prefix is not realized, resulting in adjacency between the H of the subject prefix and the H of the root, triggering downstep.

12 There is evidence that the H tone of the final OM can be recuperated onto a preceding OM. Compare the form kanaʧɔ]-ńdɹ-ło ‘s/he gave them to us’ with kanaʧɔ]-ńdɹ-ŋo ‘s/he gave him to us’ in which the H tone of the OM –ŋo is displaced onto the preceding low-toned /r/.

13 In Jenks & Rose (2011), the macrostem was proposed to include the final aspect/mood vowel. However, that analysis did not consider the downstep evidence or the tonal behavior of the consecutive imperfective. There is also some evidence for the derived stem in Moro, consisting only of the root and extension suffixes. Evidence is provided from finer details of the distribution of default H tone in Jenks & Rose (2011).

14 We formulate this as referring to the macrostem explicitly, but it could refer just to a generic “stem” category, since asessment is at the inflectional stem level.

15 Another alternative would be to assume a floating H tone that has specific association requirements. However, since this analysis does not specifically ban H tone in the macrostem, but associates H tone elsewhere, it would have little to contribute in determining the position of the OM.
As these forms all have different cophonologies, it is possible to rank **RIGHTMOST** higher than **M-STEM-H** for these particular melodic tone forms. However, this would miss the generalization that it is the tone properties of the melodic stems that makes them incompatible with high-toned OMs. Cophonologies at the same level differ minimally, and here the minimal difference relates to tone distribution within the macrostem or inflectional stem.

This is true for the speakers we have worked with on Thetogovela Moro. The dialect of Moro reported in Black & Black (1971) has prefixal **3PL OM**. However, as Black & Black do not mark tone (and in fact, state incorrectly, that Moro is not a tone language), it is not clear if the difference in the position of the **3PL OM** correlates with a difference in tone, or whether that dialect does not determine OM position through constraints on tone.

The suffix **–ŋó** appears in some constructions with **2SG** or **2PL**. This suffix has the form of the **3SG object marker**, but it does not contribute any **3SG meaning**. Recall that the OM in word-final position loses H tone after a preceding H-toned OM.