The Role of Alignment in Moro Affix Mobility: A Friendly Amendment to Jenks & Rose (2015)

Sam Zukoff, USC
samzukoff@gmail.com · www.samzukoff.com

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ABSTRACT

Moro (Kordofanian) is one of few languages which is known to display phonologically-conditioned mobile affixation. As demonstrated by Jenks & Rose (2015), object markers (OM) predictably alternate between suffixal position and prefixal position, depending on several phonological factors, namely, the tone pattern of the stem and the tone of the OM. Jenks & Rose use different cophonologies for the different stem-tone patterns, and they argue that differences in rankings in the different cophonologies are responsible for the limited distribution of affix mobility. In this reply, I show that the crucial ranking difference, obscured by certain constraints employed by Jenks & Rose, involves the relevant morphophonological alignment (RIGHTMOST), not the tonal constraints, as implied by Jenks & Rose. Therefore, while the phonological factor governing affix mobility in Moro is indeed tone, the factor governing its distribution within the grammar is alignment.

1 Introduction

Moro (Kordofanian) is one of few languages which is known to display phonologically-conditioned mobile affixation. As demonstrated by Jenks & Rose (2015) [henceforth J&R], object markers (OM) predictably alternate between suffixal position and prefixal position, depending on several phonological factors. In most cases, OM's surface as suffixes, as in all the OM forms in (1b). However, just in case the verb stem calls for the "default" tone pattern (stem-initial high tone) (1a) **and** the OM is underlyingly high-toned (1.ii), the OM surfaces as a prefix (1a.ii).

(1) **Tones and Object Markers in Moro** (J&R:270–271)[1]

			i. NO OM	ii. 2SG OM /ŋá/	iii. 3PL OM /lo/
a.	Proximal Imperfective	/-a/	vəléð-a	**ŋá-vəleð-a**	vəléð-a-lo
	Consecutive Imperfective	/-ó/	vəléð-ó	**ŋá-vəleð-ó**	vəléð-ó-lo
b.	Distal Imperfective	/á-, -ó/	á-vəleð-ó	á-vəleð-á-ŋá	á-vəleð-ó-lo
	Perfective	/-ó/	vəleð-ó	vəleð-á-ŋá	vəleð-ó-lo

J&R develop a constraint-based account of this phenomenon. Their analysis is set within Cophonology Theory (Inkelas 1998 et seq.), so as to allow the different tone patterns, which are arbitrarily distributed across particular Aspect/Mood/Deixis (AMD) constructions, to be derived by minimal constraint re-ranking.

[1] I omit all material preceding the inflectional stem. Suffix vowel-quality alternations are triggered by the following vowels.

This analysis consists of seven constraints relating to the distribution of high (H) tones (2a–g), plus one morpheme-specific alignment constraint (2h):

(2) **J&R's constraints (pp. 285, 288)**

a. **MAX-IO(H):** Do not delete H tone.
b. **DEP-IO(H):** Do not insert H tone.
c. **INTEGRITY-IO(H):** No input H can be linked to more than one output TBU.
d. ***H:** Assign one violation for every autosegmental H tone.
e. **HAVE-H:** Assign one violation mark for every TBU that is not associated with an H tone autosegment.
f. **MACROSTEM-H:** Macrostem (Mstem) must contain an H tone.
g. **ALIGN(H, L; MSTEM, L):** Align left edge of H with left edge of the macrostem.
h. **RIGHTMOST(AFFIX, L; INFLSTEM, R):** Align the left edge of prosodically deficient material with the right edge of the inflectional stem.

In this short paper, I show that their analysis actually runs on just a subset of these constraints, with some minor reformulations and ranking changes. This pared down analysis clarifies the crucial behaviors and interactions that truly characterize Moro's mobile affixation pattern.

2 Stem-tone patterns

Moro has three distinct verb tone patterns for verbal stems (specifically, the "macrostem", consisting of the root and inner affixes):

(3) **Verbal stem-tone patterns in Moro**

a. **Left-H (4a):** A single high tone (or, sometimes, two consecutive high tones) appear at or near the left edge of the stem (J&R call this "DEFAULT").
b. **All-H (4b):** All of the stem's TBU's bear a high tone (spread from the AMD suffix).
c. **No-H (4c):** None of the stem's TBU's bear a high tone.

Each AMD construction is marked by having one of these tone patterns, plus an overt suffix vowel (and, in the DISTAL IMPERFECTIVE, a prefix vowel as well). However, as evident from (4), there isn't a one-to-one mapping between tone+affix and AMD category. This leads J&R to employ a cophonology analysis of the tone patterns, whereby each given AMD category is associated with a particular constraint ranking (cophonology), which derives the tonal behavior of its stem.

(4) **Distribution of stem-tone patterns (J&R:284)**

	Tone pattern	AMD affix	Aspect/Mood/Deixis
a.	Left-H (default)	*-ó*	CONSECUTIVE IMPERFECTIVE
	Left-H (default)	*-a*	PROXIMAL IMPERFECTIVE, NEGATIVE, INFINITIVE 2 PROXIMAL, INFINITIVE 1 DISTAL, CONSECUTIVE DISTAL PERFECTIVE
	Left-H (default)	*-e*	INFINITIVE 1 PROXIMAL, CONSECUTIVE PROXIMAL PERFECTIVE
b.	All-H	*-ó*	PROXIMAL IMPERATIVE
c.	No-H	*-ó*	PERFECTIVE
	No-H	*á-, -ó*	DISTAL IMPERFECTIVE
	No-H	*-a*	PROXIMAL IMPERATIVE

3 Analysis of stem-tone patterns

To derive the three different stem-tone patterns, J&R propose three different rankings of the constraints in (2) above. In this section, I present a version of their analysis that omits *H (2d) and HAVE-H (2e), and slightly revises the ALIGN constraint (2g) in a way that makes MACROSTEM-H (2f) superfluous.[2]

First, J&R use the combination of MACROSTEM-H and ALIGN(H, L; MSTEM, L) to generate a preference that the leftmost TBU of the stem be associated with some H tone. If we swap the arguments in the alignment constraint (cf. McCarthy & Prince 1993, Hyde 2012) as in (5), more in line with Jenks & Rose's (2011) ALIGN (DSTEM, L; FT, L) (p. 229), we eliminate the need for MACROSTEM-H entirely.[3] Additionally, I change the morphological constituent from the Macrostem to the Inflection Stem [ISTEM], so as to better accommodate the OM's.

(5) **ALIGN(ISTEM, L; H, L) [ALIGN-L(IS,H)]:** Assign a violation if the left edge of the Inflectional Stem is not aligned to the left edge of some High tone.

This constraint will never be vacuously satisfied, because all verbs (whether definitionally or enforced by constraint) contain an Inflectional Stem. This definition successfully collapses the two constraints J&R propose for this purpose into a single constraint. Using this new version of the ALIGN constraint, we can now proceed to J&R's analysis of the Left-H ("default") tone pattern (p. 286).[4]

To derive this pattern, all that is crucial is to have the tonal INTEGRITY constraint (2c) and the ALIGN constraint (5) outrank the tonal DEP constraint (2b), as shown in (6). Candidate (6a), which spreads the high tone of the AMD suffix (indicated in blue) to the left edge of the stem to satisfy ALIGNL(IS,H), fatally violates INT-IO(H). Candidate (6c), which neither spreads nor epenthesizes any high tone, fatally violates ALIGNL(IS,H) because there is no H tone at the left edge of the ISTEM. This leaves candidate (6b), which actively satisfies ALIGNL(IS,H) by epenthesizing a high tone at the left edge (indicated in red), at the expense only of low ranked DEP-IO(H).

(6) **Left-H pattern (Cophonology 1)**

/vəleð-ó/		INT-IO(H)	ALIGNL(IS,H)	DEP-IO(H)
a.	vəléð-ó	*!*		
b. ☞	vəleð-ó			*
c.	vəleð-ó		*!	

Note that I abstract away from some surface details. The final surface representation of candidate (6b) would be [vəléð-↓ó], with the epenthetic H tone spreading to the second vowel, triggering downstepping of the AMD suffix's H. If we were to analyze the H tone on the second syllable as spreading of the single inserted H (which is surely the correct interpretation, because it is not downstepped), candidate (6b) would incur one INT-IO(H) violation (or maybe not, depending on how we interpret the definition; see Section 5). This is not a problem: if we fix the ranking of ALIGNL(IS,H) above INT-IO(H), which is fully consistent with the current ranking, then we continue to select (6b).

Upon inspection of this tableau, we can see that the factorial typology of these three constraints is on its own sufficient to derive all three stem-tone patterns (and only those three). This is demonstrated in tableaux (7) and (8) for the All-H and No-H patterns, respectively. Crucial to this analysis is the observation that the All-H pattern occurs only with the overtly high-toned AMD suffix /-ó/ (cf. (4b)). That is to say, the system, no matter which ranking is employed, can only satisfy ALIGNL(IS,H) via spreading if there is already an H present in the underlying representation. This confirms that the All-H pattern must be interpreted as spreading.

[2] There are complications, relating mainly to the realization of the Left-H pattern (see below), that may require additional constraints, some of whose effect may ultimately overlap with J&R's additional constraints.

[3] This idea is inspired by a comment by Jochen Trommer.

[4] In the tableaux and examples, I only show the material that constitutes the "inflectional stem" (J&R:282), which I take to be the macrostem (≈ root plus verbal extensions and aspectual prefixes), the AMD affixes, and the OM's. The left edge of the Inflectional Stem will always coincide with the leftmost material in the output, so I exclude any notation regarding stem boundaries. Note that J&R identify the OM's as being outside of the inflectional stem when they surface in suffix position. Because of the analytical changes proposed here, this move is not necessary, and OM's can always be interpreted as being internal to the inflectional stem.

(7) **All-H pattern (Cophonology 2)**

/vəleð-ó/	AlignL(Is,H)	Dep-IO(H)	Int-IO(H)
a. ☞ vəléð-ó			**
b. vəleð-ó		*!	
c. vəleð-ó	*!		

(8) **No-H pattern (Cophonology 3)**

/vəleð-ó/	Int-IO(H)	Dep-IO(H)	AlignL(Is,H)
a. vəléð-ó	*!*		
b. vəleð-ó		*!	
c. ☞ vəleð-ó			*

We have now successfully derived the three stem-tone patterns using just three constraints. There is no need for active *H or Have-H constraints. And consequently, there is no need to consider the ranking of Max-IO(H). By removing these superfluous constraints, we can now directly characterize what each cophonology is doing:

(9) **Stem-tone cophonologies**

a. **Cophonology 1:** Int-IO(H), AlignL(Is,H) ≫ Dep-IO(H)
Left-H: *acquire a left-edge H tone through H-epenthesis*

b. **Cophonology 2:** AlignL(Is,H), Dep-IO(H) ≫ Int-IO(H)
All-H: *acquire a left-edge H tone through H-spreading*

c. **Cophonology 3:** Int-IO(H), Dep-IO(H) ≫ AlignL(Is,H)
No-H: *be content without a left-edge H tone*

4 Interaction with OM's

Analyzing the stem-tone patterns is prelude to the analysis of affix mobility by the object markers (OM). J&R demonstrate that the OM's surface as suffixes (after the AMD suffix) in all cases but one: when the OM bears a high tone and the stem has the Left-H cophonology (9a). J&R achieve this by introducing the constraint Rightmost (2h), which advocates for suffixal position of the OM. As long as this constraint ranks *below* Dep-IO(H), which is violated by H-epenthesis (10b) (the normal strategy in Left-H categories), mobility (10d) will now be the preferred means of acquiring the left-edge H-tone for this stem type.

(10) **H-toned OM + Left-H stem = prefix OM**

/vəleð-ó, ɲé/	Int-IO(H)	AlignL(Is,H)	Dep-IO(H)	Rightmost
a. vəléð-ó-ɲé	*!*			
b. vəleð-ó-ɲé			*!	
c. vəleð-ó-ɲé		*!		
d. ☞ ɲé-vəleð-ó				*

(11) **L-toned OM + Left-H stem = suffix OM**

/vəleð-ó, lo/	Int-IO(H)	AlignL(Is,H)	Dep-IO(H)	Rightmost
a. vəléð-ó-lo	*!*			
b. ☞ vəleð-ó-lo			*	
c. vəleð-ó-lo		*!		
d. lo-vəleð-ó		*!		*
e. ló-vəleð-ó			*	*!

By removing the extraneous constraints from J&R's analysis, we can now pinpoint that what's driving mobility with high-toned OM's in the Left-H cophonology is the low ranking of Rightmost, below the lowest-ranked tonal constraint, Dep-IO(H). Conversely, we can also now pinpoint that the lack of mobility in the other stem-tone cophonologies is driven by a *higher* ranking of Rightmost. Specifically, it must rank

above Int-IO(H) in the All-H cophonology (12–13), and above AlignL(Is,H) in the No-H cophonology (14–15).

Recall that the All-H cophonology by default prefers to acquire a left-edge H-tone by spreading. As observed in the Left-H cophonology above, high-toned OM's present the opportunity to satisfy this preference instead through mobility. In order to avoid selecting this option, Rightmost (which penalizes mobility) must outrank Int-IO(H) (which penalizes spreading). Put another way, this ranking means that splitting (12a) remains the preferred way of obtaining a left-edge H-tone, even though mobility (12d) is now a viable option.

(12) **H-toned OM + All-H stem = suffix OM**

/vəleð-ó, ɲé/	AlignL(Is,H)	Dep-IO(H)	Rightmost	Int-IO(H)
a. ☞ vəléð-ó-ɲé				**
b. vəleð-ó-ɲé		*!		
c. vəleð-ó-ɲé	*!			
d. ɲé-vəleð-ó			*!	

(13) **L-toned OM + All-H stem = suffix OM**

/vəleð-ó, lo/	AlignL(Is,H)	Dep-IO(H)	Rightmost	Int-IO(H)
a. ☞ vəléð-ó-lo				**
b. vəleð-ó-lo		*!		
c. vəleð-ó-lo	*!			
d. lo-vəleð-ó	*!		*!	
e. ló-vəleð-ó		*!	*!	

The same goes for the No-H cophonology, where the default behavior is to make no changes at all, even if this means there is no left-edge H-tone; i.e., it permits violation of AlignL(Is,H). In order to avoid emergent satisfaction of AlignL(Is,H) via mobility in the presence of a H-toned OM, Rightmost must rank above AlignL(Is,H) in the No-H cophonology. This allows for the continued violation of AlignL(Is,H) (14c), even when mobility could solve the problem (14d).

(14) **H-toned OM + No-H stem = suffix OM**

/vəleð-ó, ɲé/	Int-IO(H)	Dep-IO(H)	Rightmost	AlignL(Is,H)
a. vəléð-ó-ɲé	*!*			
b. vəleð-ó-ɲé		*!		
c. ☞ vəleð-ó-ɲé				*
d. ɲé-vəleð-ó			*!	

(15) **L-toned OM + No-H stem = suffix OM**

/vəleð-ó, lo/	Int-IO(H)	Dep-IO(H)	Rightmost	AlignL(Is,H)
a. vəléð-ó-lo	*!*			
b. vəleð-ó-lo		*!		
c. ☞ vəleð-ó-lo				*
d. lo-vəleð-ó			*!	*
e. ló-vəleð-ó		*!	*!	

Incorporating Rightmost into the cophonologies from (9), we get the complete cophonologies in (16). Here we can see again that the crucial difference in ranking between the cophonologies that permit mobility — Left-H (16a) — and the cophonologies that don't — All-H (16b) and No-H (16c) — is the relative ranking of Rightmost and the lowest-ranked tonal constraint. No other independent difference needs to be called on in order to explain the distribution.

(16) **Stem-tone cophonologies + RIGHTMOST**

a. **Cophonology 1:** INT-IO(H), ALIGNL(IS,H) ≫ DEP-IO(H) ≫ RIGHTMOST
Left-H, OM-mobility: *acquire a left-edge H tone by moving the OM, or else through H-epenthesis*

b. **Cophonology 2:** ALIGNL(IS,H), DEP-IO(H), RIGHTMOST ≫ INT-IO(H)
All-H, OM-immobility: *acquire a left-edge H tone through H-spreading*

c. **Cophonology 3:** INT-IO(H), DEP-IO(H), RIGHTMOST ≫ ALIGNL(IS,H)
No-H, OM-immobility: *be content without a left-edge H tone*

Note that we no longer observe the full factorial typology with the addition of the fourth constraint. For each of these cophonologies, reversing the ranking of RIGHTMOST and the lowest-ranked tonal constraint will generate the opposite mobility behavior: immobility in the case of Cophonology 1; mobility in the case of Cophonologies 2 and 3. But this is not a problem in Cophonology theory; there is no expectation that variation within a language should necessarily fill out the factorial typology.

5 Discussion

In this paper, I have streamlined Jenks & Rose's (2015) analysis of stem tone and affix mobility in Moro, reducing their 8 constraints to just 4 active constraints. (There is no problem with having their additional constraints lower in the ranking, but they provide no added value to this interaction.) This reduction in analytical complexity clarifies the rankings and ranking differences that are crucial for characterizing the distribution of affix mobility. Namely, it is the fact that the alignment constraint RIGHTMOST shows different ranking properties in the different cophonologies, rather than different tonal properties *per se*, that explains why mobility is observed only in Left-H categories.

For reasons of space and clarity, I have abstracted over some properties that may complicate matters somewhat, mostly relating to the behavior of the inserted H tone in the Left-H pattern (see also Jenks & Rose 2011). For example, as mentioned in Section 3, the epenthetic H tone sometimes spreads to the second syllable. This spreading is governed by syllable structure, happening just in case the root-initial syllable is a (C)V syllable (J&R:275). It appears as though this spreading occurs in order to link the high tone to the first two TBU's of the stem (perhaps the two TBU's of a stem-initial foot; J&R:275, following Jenks & Rose 2011). Nevertheless, such spreading does not occur when the OM moves to prefixal position in the Left-H pattern. A likely solution comes from the definition of the tonal INTEGRITY constraint (2c), which penalizes splitting of *underlying tones*, but says nothing about the splitting of non-underlying (i.e. epenthetic) tones.

More problematic is the behavior of H epenthesis for vowel-initial roots (J&R:276), whose initial vowels don't bear the H tone unless they are in a closed syllable. The details of this pattern may require reversion to a gradient version of ALIGNL(IS,H), but might be compatible with the current version if we assume that root-initial vowels do not count as TBU's. Other issues like downstepping and tone reassociation after hiatus-driven deletion do require further attention, but can most likely be viewed as opaque interactions triggered later in the derivation, which is easily modeled in Cophonology theory.

Regardless, the revised analysis proposed here clarifies the relationship between tone and morpheme order in Moro, confirming that small ranking changes between different grammatical categories derive morphologically-circumscribed phonologically-driven mobile affixation.

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