





The transparency of *a* aside and substituting  $[\pm\text{ATR}]$  for  $[\text{+ATR}]$ , the salient difference between the harmony processes in Lango and Kinande is that the former is noniterative and the latter is iterative. This difference is easy to capture in most rule-based theories because “iterativity” is a basic parameter in many derivational theories (e.g. Jensen & Strong-Jensen 1976, Kenstowicz & Kisseberth 1973, Steriade 1993, Archangeli & Pulleyblank 1994). The same rule from (2) can account for Kinande if the iterativity parameter is switched on.

In contrast, vowel harmony in Lango presents Optimality Theory (OT; Prince & Smolensky 1993[2004]) with two related difficulties. The first problem is that OT cannot account for Lango and Kinande with analyses that differ only in the setting of a parameter. Thus OT loses the insight that these are related harmony processes. To illustrate the point, two analyses of Kinande vowel harmony are sketched in (4) and (5) (abstracting away from the issue of vowel transparency) using AGREE (Lombardi 1996, 1999, Baković 2000) and ALIGN (McCarthy & Prince 1993, Smolensky 1993, Kirchner 1993, Cole & Kisseberth 1995, Pulleyblank 1996), respectively, two kinds of constraints that are commonly invoked in analyses of vowel harmony. Each constraint motivates spreading throughout a word. AGREE motivates total spreading in an effort to avoid disharmonic sequences of vowels, and ALIGN motivates total spreading in an effort to match feature domains with word edges.

(4)

/tU-ka-kI-lim-a/	IDENT $[\pm\text{ATR}]$ -Root	AGREE
a. təkakılıma		*!
b. təkakilıma		*!
 c. tukakilıma		!
d. təkakılıma	*!	!

(5)

/tU-ka-kI-lim-a/	IDENT $[\pm\text{ATR}]$ -Root	ALIGN( $[\pm\text{ATR}]$ ,L;Wd,L)
a. təkakılıma		*!***
b. təkakilıma		*!*
 c. tukakilıma		!
d. təkakılıma	*!	!

However, AGREE and ALIGN cannot replicate the simple switch from iterative harmony to noniterative harmony seen in rule-based theories. The iterative force of these constraints is an emergent property, so it cannot be switched off in any easy way to transform the analysis of Kinande into an analysis of Lango. By their very nature, AGREE and ALIGN motivate spreading throughout a word, so they cannot be satisfied with the minimal spreading seen in Lango. The ease with which rule-based approaches can handle a difference in iterativity appears to argue for the correctness of derivational theories over OT.

The second problem OT faces is that it has no way to formalize the notion of “spreading to the next unit” because OT is an output-oriented, process-blind theory. If it is correct to characterize Lango’s harmony as one in which  $[\text{+ATR}]$  spreads one vowel to the left, an adequate constraint-based analysis must compare the underlying distribution of ATR features with the output featural configuration and determine whether  $[\text{+ATR}]$  has spread

to exactly one vowel. For example, the inputs /bòŋó + ní/ and /bòŋó + ní/ (the latter is hypothetical) should yield the outputs *bòŋóní* and *bòŋóní*, respectively, if the correct generalization is that [+ATR] spreads exactly once. Obviously, to know which output is correct, the markedness constraint that drives harmony must know which input is under consideration. This state of affairs is generally avoided in OT: markedness constraints must not compare inputs and outputs.

I claim in this paper that the the harmony seen in Lango is qualitatively different from Kindande’s harmony. It is therefore a mistake to shoehorn Lango’s ATR assimilation into a modification of standard analyses of harmony. Instead, Lango is best analyzed with Positional Licensing (Steriade 1994a,b, Zoll 1998a,b, Itô & Mester 1999, Crosswhite 2000, Walker 2004). In the same way the harmonizing feature in Tudanca Spanish is attracted to the stressed syllable (Walker 2004), the driving force behind Lango’s harmony is a need for suffix ATR features to be linked to a prominent position, namely the root. The apparent noniterativity of Lango’s harmony is a coincidence: In the examples in (1), the suffix is adjacent to the root, so spreading just once satisfies the licensing requirements. Other OT-based proposals for producing vowel harmony are shown to be inadequate, and there are even problems with the derivational approach founded on the rule in (2). Consequently, the argument in favor of OT’s view of the contrast between Lango and Kinande is not just a matter of theoretical taste. The rule-based approach is empirically inadequate.

This investigation raises the question of what noniterativity’s place in phonology is. (I define iterativity and noniterativity in more detail below.) Is it a setting of a formal parameter that must be explicitly incorporated into our theories, as rule-based proposals claim? The argument advanced here and based on the Positional Licensing analysis of Lango is that noniterativity does not have a place in phonology. At best it is a descriptive label we can apply when grammatical factors conspire to produce certain patterns. The OT perspective is correct: The apparent minimal difference between Lango and Kinande is an illusion masking deeper, more fundamental differences. The two languages’ harmony systems are not as related as the rule-based analysis claims.

This result means that OT does not need an explicit formalization of noniterativity, and in fact such a formalization would be misguided. Since the noniterative nature of Lango’s vowel harmony can be captured by appealing to deeper reasons for spreading [+ATR] exactly once, the analysis presented below is instructive in that it suggests that all cases of apparently noniterative spreading can be explained without recourse to a formalization of that notion.

## 2 Iterativity and Noniterativity

What is meant by the terms *iterative* and *noniterative*? I take an iterative phenomenon to be one that can be analyzed with a self-feeding rule that is allowed to reapply to its own output. A self-feeding rule is one that creates an environment to which the rule can apply again (non-vacuously). For example, in the rule-based analysis of Kinande vowel harmony discussed above, the rule in (2), when the iterativity parameter is turned on, will spread ATR features leftward from one vowel to another until the beginning of the word is reached.

This sort of rule is proposed by Anderson (1971), Kenstowicz & Kisseberth (1973), Jensen & Strong-Jensen (1976), Vago (1973), Steriade (1993), and Archangeli & Pulleyblank (1994), among others.

There are many ways to implement iterativity in a formal system that do not rely on the reapplication of self-feeding rules *per se*. Perhaps the most well-known alternative is the simultaneous rule application of Chomsky & Halle (1968). Under their formalism, a rule may apply only once per cycle. When a rule applies, the string is scanned for all possible targets, and these targets are changed simultaneously. With their parenthesis-star notation, phenomena like Kinande’s vowel harmony can be produced by identifying all non-low vowels left of the root vowel (by allowing any number of CV sequences between the target and a trigger) and changing them all at once. While this system rejects the idea that features may propagate toward the edge of the word, the result is largely the same.

The early generative phonology literature also makes the distinction between *linear* rules and *iterative* rules. Johnson (1970) argues in favor of linear rules (which start at one end of a string and change the first target they find, and then proceed to the next target without backtracking through parts of the string they’ve already scanned) as opposed to iterative rules (which are roughly the same except that they backtrack to the beginning of the string on each iteration). Linear rules are also roughly what Howard (1973) argues for.

I am not concerned here with distinctions between these different rule types. They are all capable of producing iterative phenomena as I defined the term above. For the purposes of the current investigation, they are sufficiently equivalent (see Johnson (1970) for an investigation of their important formal differences), and I refer to them collectively as *iterative* rules when they are intended to account for iterative phenomena.

For the purposes of defining noniterativity, it is useful to think of iterativity in terms of the reapplication of a self-feeding rule. For my purposes, a noniterative phenomenon is one that must be analyzed in the rule-based frameworks under discussion with a self-feeding rule that does *not* reapply to its own output. In other words, a noniterative version of Kinande’s harmony is one that requires the same rule as Kinande except that this rule must not be allowed to reapply. This is the sort of phenomenon that Lango appears to exhibit, and I claim that no noniterative phenomena (under the current definition) exist.

There are many phenomena that are what I will call *trivially noniterative*. These are phenomena that can but need not be analyzed with a noniterative self-feeding rule. They are trivially noniterative not because they’re easy to account for, but because they may be analyzed with either an iterative rule or a noniterative rule. One such phenomenon is Nati, from Sanskrit. In Nati, retroflexion spreads from *ṣ* or *r* rightward to *n*. (Data from Gafos (1999) and Kiparsky (1985); see also Whitney (1889), Allen (1951), Kiparsky (1985), Schein & Steriade (1986), Cho (1991), Ní Chiosáin & Padgett (1997), among others. Following the practice of these authors, retroflexion is marked with a dot under the consonant, except that *r* is always retroflex.)

- |     |    |            |            |
|-----|----|------------|------------|
| (6) | a. | pūr-ṇā     | ‘fill’     |
|     | b. | vṛk-ṇa     | ‘cut up’   |
|     | c. | brāhmaṇ-ya | ‘devotion’ |

d.	kṛp-a-māṇa	‘lament’
e.	kṣubh-āṇa	‘quake’
f.	cakṣ-āṇa	‘see’

Only the first *n* after *ṣ* or *r* is targeted. Thus /varṇ-anā-nām/ ‘descriptions (gen. pl.)’ becomes varṇanānām, not \*varṇaṇānām. This is trivially noniterative because, as Kiparsky (1985) and Gafos (1999) point out, a second iteration of spreading is impossible: only *ṣ* and *r* trigger spreading, so in the configuration ...*ṣ*/*r*...*n*...*n*..., the final *n* cannot become *ṇ* because retroflexion cannot spread from the preceding *n*. Not even an appropriately formulated iterative rule will target the second *n*.<sup>2</sup>

Another trivially noniterative phenomenon is final devoicing as in, e.g., German. Word-final (or syllable-final) obstruents devoice, but since just one segment can be word-final, only one segment can be devoiced. An iterative rule that targets word-final segments has just one segment to change no matter how many times it reapplies. Likewise, in dialects of English in which vowels become nasalized when preceding nasals, a rule that iteratively spreads nasality from nasals to adjacent preceding vowels will never affect more than one vowel because only one vowel can precede and be adjacent to a nasal consonant. And in nasal place assimilation (Padgett 1997), if nasals in NC clusters must acquire the place features of the immediately following consonant, no more than one nasal will assimilate in any instance because only one nasal segment can immediately precede a consonant. It does not matter whether one adopts an iterative or noniterative rule for this process, and a constraint-based analysis can be built on constraints promoting certain featural combinations in adjacent segments as in Pulleyblank (2002). These are trivially noniterative phenomena because they do not require noniterative rules. They contrast with noniterative processes whose rules must be prevented from reapplying to their own outputs.

It is the latter that I claim to be nonexistent: There is no phenomenon that *requires* a noniterative rule, and therefore OT need not be able to replicate the effect of a (crucially) noniterative rule. I subsequently refer to the latter as noniterative and set aside trivially noniterative phenomena, which clearly exist and are not problematic for any theoretical framework I am aware of, including OT. Although Lango looks like a case of nontrivial noniterativity in that an iterative rule is clearly inappropriate (it would produce Kinande), I argue below that Lango’s harmony is not in fact noniterative.

In order to support the thesis that noniterativity is absent from phonology, a typological survey is required. I discuss the most promising cases from a survey that I have begun in section 6. All of the cases of apparent noniterativity identified so far can be (and in some cases have been) analyzed in other terms.

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<sup>2</sup>It is possible to construct a Positional Licensing analysis of Nati along the lines of the analysis developed for Lango below. Suppose only [–continuant] consonants can license retroflexion. That this is correct—for whatever reason—is suggested by the fact that the sources of spreading, *ṣ* and *r*, are the only [+continuant] retroflex segments in Sanskrit. With a constraint motivating spreading rightward to the next [–continuant] coronal for the purposes of licensing, spreading to *n*, *t*, *d* can be produced. High-ranking faithfulness to stops’ place of articulation can block this spreading when *t*, *d* are the targets, so only spreading to *n* is permitted, even though spreading to *t*, *d* would also satisfy Positional Licensing. And once an acceptable spreading target has been reached, Positional Licensing motivates no further spreading.

### 3 Harmony in Lango

The data in (1) are just a small part of Lango’s ATR harmony. There are five [+ATR] vowels and five [-ATR] vowels in the language, shown in (7) based on descriptions in Noonan (1992). The correspondences are the obvious ones, with the low *a* alternating with the mid *ə*.

(7)	a.	i	u		b.	ɪ	ʊ
		e	o			ɛ	ə
		a				ɔ	

Either value of [ $\pm$ ATR] may spread, and harmony can be either progressive or regressive, except that [-ATR] never spreads regressively. Suffixes but not prefixes participate in harmony. The data in (8) illustrate progressive spreading of [+ATR]. The suffixes shown are /-a/ ‘1st person singular possessive inalienable’ and /-ɛ/ ‘3rd person singular possessive inalienable.’ Underlying vowel quality is recoverable from disharmonic forms, some of which are discussed in (22) below. The forms in (9) show these suffixes when attached to stems with [-ATR] vowels. As those forms are underlyingly harmonic, no change is necessary, and the suffixes surface faithfully in contrast with (8). All Lango data are from Woock & Noonan (1979), Noonan (1992), Smolensky (2006), and tones are given only when they are provided by these sources.

(8)	<i>Root</i>	<i>Gloss</i>	<i>1sg poss.</i>	<i>3sg poss.</i>
	a.	ɲùt ‘neck’	ɲùt-á	ɲùt-ɛ
	b.	wót ‘son’	wót-á	wót-ɛ
	c.	ém ‘thigh’	ém-á	ém-ɛ
	d.	ɲèt ‘side’	ɲèt-á	ɲèt-ɛ
	e.	ɲím ‘forehead’	ɲím-á	ɲím-ɛ
	f.	cíɲ ‘hand’	cíɲ-á	cíɲ-ɛ

(9)	a.	bwóm ‘wing’	bwóm-á	bwóm-ɛ
	b.	wàɲ ‘eye’	wàɲ-á	wàɲ-ɛ
	c.	léb ‘tongue’	léb-á	léb-ɛ
	d.	tyén ‘leg’	tyén-á	tyén-ɛ
	e.	yìc ‘stomach’	yì-á	yì-ɛ <sup>3</sup>
	f.	yíb ‘tail’	yíb-á	yíb-ɛ

The Positional Licensing analysis developed below is based largely on the analysis of Smolensky (2006), which itself draws heavily on the analysis of Archangeli & Pulleyblank (1994). For Smolensky, harmony is driven by the AGREE constraint in (10).

(10) AGREE([ $\pm$ ATR]): Vowels in adjacent syllables must have the same value for [ $\pm$ ATR].

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<sup>3</sup>Woock & Noonan (1979), from whom this example is taken, do not comment on the loss of *c*.

With no directionality or morpheme dominance specified in this constraint, it falls to other constraints to filter the set of AGREE-satisfying candidates by ruling out certain spreading configurations. These filtering constraints are derived from the local conjunction (Smolensky 1995) of basic constraints. See Smolensky (2006:86–94) for the formal definitions and complete motivations for the filtering constraints. Only informal definitions are given here. For each form with [+ATR] spreading, some constraint must rule out the candidate with [-ATR] spreading, and *vice versa*. Consequently, explaining why one value of [ $\pm$ ATR] spreads consists of explaining why the other value cannot spread.

One of Smolensky’s six filtering constraints is at work in (8), where the root vowels’ [+ATR] specifications spread to /-a/ or /-ε/. Regressive [-ATR] spreading from the suffixes to the roots is ruled out by the constraint in (11).  $\mathbb{C}_X$  prevents regressive spreading of [-ATR] and is responsible for the fact that only [+ATR] spreads regressively in Lango. Within Smolensky’s theory, the source of spreading is the head of the harmonic domain, so  $\mathbb{C}_X$  blocks right-headed [-ATR] domains.

(11)  $\mathbb{C}_X$ : No regressive [-ATR] spread.

To give more examples of progressive [+ATR] harmony, the data in (12) show harmony within finite verbs. The harmonizing suffix is /-a/ ‘1st person singular object.’ A full gloss is given for (12-a) only. The remaining sentences vary only in terms of the verb root. [+ATR] harmony is optimal because  $\mathbb{C}_X$  blocks [-ATR] harmony. The forms in (13) are underlyingly harmonic and verify that the suffix does indeed alternate.

- (12) a. dákó ò-rùk-ó  
 woman 3sg.subj-dressed-1sg.obj  
 ‘The woman dressed me.’
- b. dákó ò-rùc-ó ‘The woman confused me.’  
 c. dákó ò-pwòd-ó ‘The woman beat me.’  
 d. dákó ò-pòn-ó ‘The woman avoided me.’  
 e. dákó ò-cèl-ó ‘The woman hit me.’  
 f. dákó ò-bìt-ó ‘The woman lured me.’  
 g. dákó ò-wìj-ó ‘The woman heard me.’
- (13) a. dákó ò-lòb-á ‘The woman followed me.’  
 b. dákó ò-lwòk-á ‘The woman washed me.’  
 c. dákó ò-kòj-á ‘The woman helped me.’  
 d. dákó ò-jwàt-á ‘The woman hit me.’  
 e. dákó ò-kàn-á ‘The woman hid me.’  
 f. dákó ò-nèn-á ‘The woman saw me.’  
 g. dákó ò-tèl-á ‘The woman pulled me.’  
 h. dákó ò-lìm-á ‘The woman visited me.’  
 i. dákó ò-lìk-á ‘The woman struggled with me.’

(14) and (15) show regressive spreading of [+ATR] with spreading from a suffix to a root. The suffixes in (14) are /-Ci/ ‘2nd person singular possessive,’ /-wu/ ‘2nd person plural possessive,’ and /-i/ ‘2nd person singular object.’

(14)	a.	kóm	‘chair’	kòm-mí	‘your (sg) chair’
	b.	kóm	‘chair’	kòm-wú	‘your (pl) chair’
	c.	bó	‘net’	bó-wú	‘your (pl) net’
	d.	còŋ	‘chaff’	bù-wú	‘your (pl) chaff’
	e.	jò	‘people’	jò-wú	‘your (pl) people’
	f.	dèk	‘stew’	dèk-kí	‘your (sg) stew’
	g.	lè	‘net’	lè-wú	‘your (pl) net’
	h.	pí	‘for’	pì-wú	‘for you’

(15) ò-kòp-í ‘she helped you’ (cf. (13-c))

Progressive [-ATR] harmony is ruled out by Smolensky in (14) and (15) by  $\mathbb{C}_Z$ , defined in (16). Progressive harmony would yield  $\upsilon$  and  $\iota$  in the suffixes, and high [-ATR] vowels are disfavored on articulatory grounds (Archangeli & Pulleyblank 1994): Retracting the tongue root conflicts with the raising gesture required for a high vowel.

(16)  $\mathbb{C}_Z$ : \*[-ATR, +hi]

In addition, the final three forms in (14) are subject to  $\mathbb{C}_Y$  (17). The source of [-ATR] spreading cannot be a front vowel. This restriction is also articulatorily motivated (Archangeli & Pulleyblank 1994). Retraction of the tongue root conflicts with fronting the tongue body, so front lax vowels make poor heads of harmonic domains. For mnemonic reasons, Smolensky uses  $[\pm\text{front}]$  instead of  $[\pm\text{back}]$ , but the two features are equivalent such that  $[\alpha\text{front}] = [-\alpha\text{back}]$ .<sup>4</sup> Both  $\mathbb{C}_Y$  and  $\mathbb{C}_Z$  prevent [-ATR] harmony in the last three forms in (14).

(17)  $\mathbb{C}_Y$ : No [-ATR] spread from a [+front] vowel.

There are also constraints that militate against [+ATR] spreading in certain cases. Some examples of progressive [-ATR] spreading are shown in (18). The infinitival suffix /-Co/ alternates depending on the stem it is attached to. [-ATR] spreading is not blocked in these cases (i.e.,  $\mathbb{C}_X$ ,  $\mathbb{C}_Y$ , and  $\mathbb{C}_Z$  are not violated), and the constraint preventing [+ATR] spreading is  $\mathbb{C}_2$ , defined in (20). The forms in (19) are underlyingly harmonic and show the underlying specifications of the suffix vowel.

(18)	<i>Root</i>	<i>Gloss</i>	<i>Infinitive</i>
	a. lwɔk	‘wash’	lwɔk-kɔ

<sup>4</sup>The mnemonic device employed by Smolensky may be helpful here as well: The ‘+’ values of  $[\pm\text{ATR}]$ ,  $[\pm\text{hi}]$ , and  $[\pm\text{front}]$  are all compatible (i.e. they all involve raising or fronting of the tongue), as are the ‘-’ values of each feature (involving backing or lowering of the tongue). Segments with a mixture of ‘+’ and ‘-’ values for these features require conflicting tongue gestures and are therefore marked.

- b. lɔb ‘follow’ lɔb-bɔ
- c. ɲɔn ‘step on’ ɲɔn-nɔ
- d. jɔk ‘stop’ jɔk-kɔ

- (19)
- a. riŋ ‘run’ riŋ-ŋɔ
  - b. ket ‘put’ ket-to
  - c. ruc ‘entangle’ ruc-co
  - d. pwod ‘beat’ pwod-do

- (20)  $\mathbb{C}_2$ : No regressive [+ATR] spread from a [-hi] source.

Just as the articulatory gestures required by [-ATR] and [+hi] make conflicting demands on the tongue, so do [+ATR] and [-hi]. Since non-high tense vowels are marked, they make poor heads of [+ATR] domains.

Additionally,  $\mathbb{C}_3$  (21) rules out [+ATR] harmony in (18-a) and (18-c). Both [-front] and [-hi] conflict with the articulatory demands of [+ATR], so tense back vowels make poor heads of harmonic domains, and spreading [+ATR] to a [-hi] vowel is discouraged.

- (21)  $\mathbb{C}_3$ : No regressive [+ATR] spread from a [-front] V onto a [-hi] V in a closed syllable.

Finally, in some cases, harmony fails and a disharmonic word appears. Examples of this sort are given in (22). In these cases, spreading of each value of [ $\pm$ ATR] is ruled out by one of the filtering constraints. For example, in (22-i), [+ATR] spreading is blocked by  $\mathbb{C}_2$ , and [-ATR] spreading is blocked by  $\mathbb{C}_Y$ . With neither harmonic option escaping the filtering constraints, AGREE is violated by the optimal candidate. Smolensky (2006) uses these forms to argue that the filtering constraints must outrank AGREE: Harmonic candidates only win if they incur no violations of the filtering constraints. Notice also that disharmonic forms can be used to verify the underlying specifications of the suffixes discussed above.

- (22)
- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>a. twòl-lá ‘my snake’</li> <li>b. gwók-ká ‘my dog’</li> <li>c. búk-wá ‘our book’</li> <li>d. búk-gí ‘their book’</li> <li>e. gwèn-ná ‘my chicken’</li> <li>f. rwót-tá ‘my chief’</li> <li>g. dòk-ká ‘my cattle’</li> <li>h. ɲèŋ-ŋá ‘my crocodile’</li> </ul> | <ul style="list-style-type: none"> <li>i. lɪm-mo ‘to visit’</li> <li>j. way-o ‘to pull’</li> <li>k. cam-mo ‘to eat’</li> <li>l. nɛn-no ‘to see’</li> <li>m. dɛp-po ‘to gather’</li> <li>n. dèk-wú ‘your (pl) stew’</li> <li>o. ò-cèl-wá ‘she hit us’</li> <li>p. ò-cèl-gí ‘she hit them’</li> </ul> |
|---|---|

The forms in (22-a)–(22-h) motivate another filtering constraint. Since they only block (certain instances of) regressive [+ATR] spreading, neither  $\mathbb{C}_2$  nor  $\mathbb{C}_3$  prevents progressive [+ATR] harmony in these forms. Smolensky adopts  $\mathbb{C}_1$  (23) to account for (22-a)–(22-h). Again, [+ATR] and [-hi] conflict, so a vowel with these features makes a poor domain head.

- (23)  $\mathbb{C}_1$ : No [+ATR] spread from [-hi] source in closed syllable.

Compare (22-a)–(22-h) to (24), where [+ATR] harmony whose source is in a closed syllable is allowed because the source vowel in those forms is high.

(24)	<i>Root</i>	<i>Gloss</i>	<i>1sg. poss.</i>
	a. búk	‘book’	búk-kó
	b. òpúk	‘cat’	òpúk-kó
	c. píǵ	‘juice’	píǵ-gó

To reiterate a point made above in passing, if the root and suffix vowels are already harmonic, nothing changes, as the examples in (25), plus many of the examples above, show:

(25)	a.	dèk-ká	‘my stew’
	b.	òt-tá	‘my house’
	c.	ɲóɲ-ɲí	‘your (sg) crocodile’
	d.	rwót-tí	‘your (sg) chief’
	e.	búk-kí	‘your (sg) book’
	f.	ɲìɲ-wú	‘your (pl) name’

To summarize, Lango has four strategies to deal with disharmonic root-suffix combinations: progressive [+ATR] spreading (8), regressive [+ATR] spreading (14), progressive [-ATR] spreading (18), and no spreading at all (22).

Noonan (1992) has a very different view of Lango’s harmony than Smolensky. Noonan claims that [+ATR] is the dominant feature, and it may spread progressively or regressively. Harmony is blocked by CV suffixes unless the suffix vowel (and for some speakers also the root vowel) is [+high]. [-ATR] is claimed not to spread, and the forms in (18) are treated as exceptions since they all involve the stem-vowel suffix /-o/. I have selected Smolensky’s analysis as the basis for mine because Smolensky’s analysis incorporates the data from (18) into the more general harmony system so that they are not exceptional. The [+ATR]-dominance approach is equally compatible with Positional Licensing, as I discuss below.

The implication of Noonan’s characterization of Lango is that ATR is privative, and only [+ATR] is phonologically present. Noonan claims that the suffix in (18), -o, only appears when the root contains ɔ or ʊ. While [-ATR] spreading is itself incompatible with privativity (and hence privativity is not adopted here), it is tempting to invoke allomorph selection to skirt the issue: The suffixes in (18) and (19) are separately listed allomorphs, and the one lacking an ATR feature is selected when the root contains a back non-low vowel that also lacks an ATR feature. However, Noonan (1992:272, n. 31) notes that some speakers additionally allow the [-ATR] allomorph when the root contains  $\varepsilon$ . Since  $\varepsilon$ , ɔ, ʊ is not a natural class in Lango, the rules governing allomorph selection would have to be more complex for these speakers, and in any case it remains a coincidence that the allomorph unspecified for ATR only appears with root vowels that are also unspecified for ATR. The inability of a phonological process to require a feature’s absence is one of the attractions of privativity in general, but this principle conflicts with the present facts. Specifying that the lax suffix is the default and that the [+ATR] variant appears only with [+ATR] root vowels is not a viable alternative: forms like wàlô ‘to boil (intransitive),’ ryèttò ‘to

winnow (intransitive),’ and *nyikò* ‘to move slightly away’ show that this in an incorrect generalization. It seems simpler to abandon privativity and allow [-ATR] to spread from  $\varepsilon$ ,  $\alpha$ ,  $u$  because, as non-high and/or back vowels, they’re satisfactory heads of [-ATR] domains.

The pieces of the Smolensky (2006) analysis are now in place. The filtering constraints (henceforth the “C constraints”) are given in (26).  $C_1$ ,  $C_2$ , and  $C_3$  determine when [+ATR] may spread, and  $C_X$ ,  $C_Y$ , and  $C_Z$  determine when [-ATR] may spread.

(26) *Summary of Constraints from Smolensky (2006)*

$C_1$ : No [+ATR] spread from [-hi] source in closed $\sigma$ .	}	<i>regulate [+ATR] spread</i>
$C_2$ : No regressive [+ATR] spread from a [-hi] source.		
$C_3$ : No regressive [+ATR] spread from a [-front] V onto a [-hi] V in a closed $\sigma$ .		
$C_X$ : No regressive [-ATR] spread.	}	<i>regulate [-ATR] spread</i>
$C_Y$ : No [-ATR] spread from a [+fr] vowel.		
$C_Z$ : *[-ATR, +hi]		

In (27)–(29), Tableaux show Smolensky’s analysis in action, with IDENT([±ATR]) replacing the equivalent F[ATR] from his Tableaux. In (27), the candidate with [-ATR] harmony—candidate (c)—violates both  $C_Y$  (because the source of the [-ATR] feature is a front vowel) and  $C_Z$  (because harmony yields a [+high, -ATR] vowel) and is therefore eliminated. Candidate (b), with [+ATR] harmony, violates none of the C constraints and therefore emerges as the winner, candidate (a) having been eliminated by AGREE([±ATR]).

(27) *[+ATR] Spreading*

/pí + wú/	$C_1$	$C_2$	$C_3$	$C_X$	$C_Y$	$C_Z$	AGREE	IDENT([±ATR])
a. pì-wú							*!	
☞ b. pì-wú								*
c. pì-wú					*!	*!		*

Conversely, in (28), candidate (b), with [+ATR] harmony, violates  $C_2$  because the source of the [+ATR] feature is a non-high vowel and the spreading is regressive. Also,  $C_3$  is violated because [+ATR] spreads regressively from a back vowel, and the target vowel is non-high and in a closed syllable. Consequently, the [+ATR] harmonic candidate is eliminated. But the [-ATR] harmonic candidate (candidate (c)) doesn’t violate any of the C constraints and is optimal. As before, the disharmonic candidate (a) is eliminated by AGREE([±ATR]).

(28) *[-ATR] Spreading*

/lwək + Co/	$C_1$	$C_2$	$C_3$	$C_X$	$C_Y$	$C_Z$	AGREE	IDENT([±ATR])
a. lwək-ko							*!	
b. lwok-ko		*!	*!					*
☞ c. lwək-kə								*





suffix's [+ATR] feature leftward one syllable to eliminate one violation of ALIGN will always be inferior to spreading yet another syllable to the left, which removes a second violation.

Consequently, standard harmony constraints like AGREE and ALIGN cannot account for the full range of facts in Lango. What constraint(s) should be used instead? If harmony in Lango is truly noniterative (in the sense described above), the harmony-driving markedness constraint must be able to compare the output to the input in order to judge the extent of spreading.<sup>8</sup> To correctly produce both *òpúk-kó* 'my cat' (from (24-b)) and *bòḡó-ní* 'your dress' (1-a), constraints must know that the first form underlyingly has two [+ATR] vowels, and so the output should have three, while the second form has one [+ATR] vowel, and its output should have two harmonic vowels. This power is typically unavailable to markedness constraints, which must evaluate outputs on their own merits without regard for inputs.

We are therefore confronted with two problems: First, if the assimilation seen in Lango is a case of vowel harmony, it should be produced with standard harmony-driving constraints in the way the same rule can account for both Lango and Kinande with just a change in one parameter. Because of the sour grapes problem, this is not possible. Second, the constraint that must replace standard harmony drivers to account for Lango should require strictly noniterative spreading, and this seems impossible given the standard assumptions of OT.

These conundrums disappear if we deny that Lango possesses genuine vowel harmony (perhaps the assimilation is more closely related to metaphony and umlaut) and that this assimilation is fundamentally noniterative. A closer look at Lango reveals that both assumptions are questionable. It is therefore unsurprising—and even desirable—that Lango and standard harmony necessitate distinct analyses. Furthermore, some data presented below show spreading beyond what noniterativity would permit, it is a mistake to stipulate that assimilation is necessarily noniterative. Under the Positional Licensing analysis pursued here, the impetus for minimal harmony is couched in terms that do not refer to noniterativity, although spreading to just the adjacent syllable is the typical result.

## 4 Licensing as an Alternative to Iterativity

### 4.1 The Licensing Analysis

There are several reasons to think that Positional Licensing (Zoll 1998b, Crosswhite 2000), and not a harmony-specific mechanism, is responsible for ATR harmony in Lango. To begin, we've already seen that root-affix assimilation creates disharmonic stems (see (30)). Harmonic systems, in which all (non-transparent or -opaque) vowels in a domain have the same specification for a feature, do not typically undo an existing harmonic domain to produce another harmonic domain. If Lango had true vowel harmony, we'd expect all root vowels to change under suffixation in (30). The fact that underlyingly harmonic roots can become disharmonic is evidence that root harmony *qua* harmony is no longer active in Lango, if it ever was.

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<sup>8</sup>It is possible to limit the extent of spreading by self-conjoining Faithfulness constraints to allow no more than one vowel to change its ATR specification. See Section 5.4 for arguments against this approach.

Furthermore, from a harmonic point of view, the outputs in (30) are often no better than their inputs. For example, *b̀̀̀́́́* ‘your dress’ has a disyllabic domain of harmony plus one vowel that does not harmonize. Its input, */b̀̀̀́́́/*, has exactly the same configuration. All that changes is the order of the harmonic and disharmonic domains. Setting aside the sour-grapes problem, standard harmony constraints can prefer the output to the input in this case (e.g., Alignment might favor *b̀̀̀́́́* because the two ATR domains are closer to the left edge of the word), but it is hard to characterize the input-output mapping as one driven by harmony concerns: homogeneity is not generated.

In Addition, while most roots are harmonic, a number aren’t:

(33)	a.	<i>cúpa</i>	‘bottle’	f.	<i>kàkwènè</i>	‘where’
	b.	<i>òmín</i>	‘brother’	g.	<i>láŋô</i>	‘Lango’
	c.	<i>àbòlò</i>	‘plantain’	h.	<i>níâŋ</i>	‘sugarcane’
	d.	<i>bìlò</i>	‘charcoal’	i.	<i>òbíâ</i>	‘money’
	e.	<i>gwènò</i>	‘chicken’	j.	<i>òlwit</i>	‘eagle’

To the best of my knowledge, these examples are all monomorphemic, and they provide a representative sample of the disharmonic forms found in Woock & Noonan (1979) and Noonan (1992). Their presence indicates that ATR harmony, while perhaps historically real considering the vast number of harmonic roots, is not synchronically active in the language. Even languages that uncontroversially have full-fledged harmony systems often contain disharmonic exceptions, but the roots in (33) show that there is no exceptionless generalization to be made about vowel co-occurrence restrictions in roots in terms of the combinations of ATR specifications that are allowed. Taken with the other evidence against a harmony system in Lango, these roots point toward a view of Lango that does not involve vowel harmony *per se*.

These factors mean we don’t have to shoehorn the one-syllable spreading into a harmony system. Rather, the disharmonic forms in (33) indicate that some other mechanism is responsible for Lango’s “harmony.”<sup>9</sup>

In light of evidence that Lango does not exhibit “harmony” as the term is traditionally understood, it is worth considering other possible motivations for the one-syllable spreading seen in (30). The argument put forth in this section is that harmony in Lango is best understood as an effect of Positional Licensing. An analysis of the data presented in the previous section is developed here, building on the analysis of Smolensky (2006).

The property that all the cases of harmony share is that after assimilation, the suffix vowel shares its ATR specification with some root segment. I claim that this is the goal. Roots are “prominent positions which license more contrasts than other non-prominent positions” (Urbanczyk 2006:194; see also Steriade 1995, Beckman 1999). Consequently, the suffix vowel’s ATR feature is more prominent (i.e. more likely to be correctly perceived) if it

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<sup>9</sup>I will continue to call the assimilations under consideration “harmony” both to maintain terminological consistency with previous analyses and because—arguments in this section notwithstanding—this is harmony in the sense that some string of vowels must have some feature in common. The label we assign the phenomenon is less important than how we analyze it.

is also carried by a root vowel. This is exactly the intuition captured by Positional Licensing: The feature  $[\pm\text{ATR}]$  is *licensed* on roots (cf. Generalized Licensing (Walker 2004)):

(34) LICENSE-[ATR]:  $[\pm\text{ATR}]$  features must be linked to root segments.<sup>10</sup>

This constraint says, essentially, that a contrast based on  $[\pm\text{ATR}]$  is only permitted in roots, and the justification is that roots are more prominent than affixes. Of course, non-root vowels in a well-formed surface structure must be specified for this feature, but LICENSE-[ATR] does not penalize such specifications as long as they're shared by some root segment. Notice also that LICENSE-[ATR] is satisfied by spreading in either direction. Given a disharmonic root/suffix vowel pair, it does not matter which segment's feature survives in the output as long as the feature on the suffix vowel is also linked to a root vowel. (LICENSE-[ATR] is also satisfied by deletion of suffix vowels since this would eliminate non-root sites for ATR features to be linked to. This means MAX or possibly REALIZE-MORPH (Kurusu 2001) must be highly ranked in Lango.)

With LICENSE-[ATR] replacing AGREE from Smolensky's (2006) analysis, minimal spreading is preferred:

(35)

/bòŋó + ní/	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>X</sub>	C <sub>Y</sub>	C <sub>Z</sub>	LIC-[ATR]	IDENT( $[\pm\text{ATR}]$ )
a. bòŋó-ní							*!	
b. bòŋó-ní								*
c. bòŋó-ní								**!
d. bòŋó-ní						*!		*

The extent of spreading doesn't matter to LICENSE-[ATR] as long as the suffix vowel and some root vowel share their ATR specification. Only the fully faithful candidate (a) violates LICENSE-[ATR]. Crucially, candidate (b) no longer violates the harmony-driving constraint (LICENSE-[ATR] here; cf. AGREE in (31) above). C<sub>Z</sub> eliminates the candidate in which the suffix vowel takes on the ATR feature of the root vowels. ATR spreading must be regressive if LICENSE-[ATR] is to be satisfied. The question is: How large is the optimal domain of harmony? LICENSE-[ATR] is satisfied equally by candidates (b) and (c). The decision falls to lower-ranked constraints in the normal OT fashion. IDENT( $[\pm\text{ATR}]$ ) selects the candidate that does minimal violence to the input. The form in which the suffix's  $[\pm\text{ATR}]$  feature spreads only to the root-final vowel wins: One violation of IDENT( $[\pm\text{ATR}]$ ) is required by LICENSE-[ATR], but a second violation is unnecessary. In this way, LICENSE-[ATR] (combined with lower-ranking Faithfulness) motivates minimal spreading. Noniterative spreading is a consequence of the word's morphological configuration and represents the minimal unfaithfulness to the input necessary to satisfy LICENSE-[ATR]. No explicitly noniterative constraint is necessary. Noniterativity falls out from other considerations.


<sup>10</sup>It is equally possible to formalize this constraint in the vein of COINCIDE (Zoll 1998a, Itô & Mester 1999). The result would be a constraint requiring the scope of  $[\pm\text{ATR}]$  to coincide with the scope of the root. The LICENSE and COINCIDE formulations seem to be functionally equivalent in the present case ("coincide with" = "be linked to") and they are designed to capture the same intuitions.

The forms in (36) provide more evidence that root-licensing is the goal of spreading.

- (36)
- a. t̀òj-érê ‘beat up’
  - b. ẁùc-érê ‘throw’
  - c. nèk-érê ‘kill’
  - d. rẁèɲ-érê ‘lose’
  - e. c̀èg-érê ‘close’
  - f. k̀òb-èrê ‘transfer’
  - g. m̀è-èrê ‘intoxicate’<sup>11</sup>
  - h. à-c̀âɲ-èrê ‘I healed myself’
  - i. cul-lerè ‘penis (3sg alien)’
  - j. k̀ùl-lérê ‘wart hog (3sg alien)’
  - k. gẁòk-kérê ‘dog (3sg alien)’

Two suffixes are illustrated here: the middle voice suffix /-érê/ in (36-a)–(36-h), and the third-person singular possessive alienable suffix /-mérê/. Both suffix vowels harmonize.<sup>12</sup> These forms are incompatible with a strictly noniterative view of Lango’s harmony. An analysis built on the noniterative rule from (2) predicts (once we allow the rule to apply as written and as its the mirror image would require) outputs such as \*t̀òj-érê. Only the first suffix vowel changes because [ $\pm$ ATR] is allowed to spread exactly once, just as only the first root vowel changes in cases of regressive spreading. A noniterative rule is fatally flawed, and an additional iterative rule must be invoked to account for (36). The Licensing analysis, in contrast, already produces these words:

(37)

/t̀òj + érê/	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>X</sub>	C <sub>Y</sub>	C <sub>Z</sub>	LIC-[ATR]	IDENT([ $\pm$ ATR])
a. t̀òj-érê							*!*	
b. t̀òj-érê							*!	*
 c. t̀òj-érê								**
d. t̀òj-érê				*!	*!	*!		*

Licensing is not satisfied unless both suffix vowels harmonize. If just one vowel harmonizes, the other’s ATR feature will not be adequately licensed. In the candidate with noniterative spreading, \*t̀òj-érê, the final vowel’s [–ATR] feature is not linked to the root.

The noniterative rule-based analysis can be salvaged by assuming the vowels in /-érê/ represent a single set of features linked to two timing slots, as shown in (38). The alternative is (39), with separate features for each vowel.

<sup>11</sup>This form comes from /m̀er + èrê/ (Noonan 1992:101), but Noonan is silent on the loss of *r*.

<sup>12</sup>I follow Noonan (1992) and Smolensky (2006) in assuming these suffix vowels are underlying lax. The data in (36) are also compatible with an assumption that tense vowels are underlying. In this case, the same argument presented here holds except that roots with lax vowels trigger spreading rather than roots with tense vowels.



options as produced by the Licensing analysis; cf. the Tableaux in Smolensky (2006:95–97). Beginning with the simplest cases, (40) shows regressive [+ATR] spreading between a monosyllabic root and a monosyllabic suffix in *jò-wú* ‘your people.’ Progressive harmony is blocked by  $C_Z$  because the resulting configuration has a [+hi, +ATR] vowel.

(40)

	/jò + wú/	$C_1$	$C_2$	$C_3$	$C_X$	$C_Y$	$C_Z$	LIC-[ATR]	IDENT([±ATR])
a.	jò-wú							*!	
☞	b. jò-wú								*
	c. jò-wú						*!		*

Progressive [+ATR] harmony is shown in (41) with the word *píg-gó* ‘juice (1sg alien).’ Regressive [-ATR] spreading is blocked by  $C_X$  as usual, and in this case the [-ATR] configuration is ruled out by  $C_Z$  as well because this candidate has a [+hi, -ATR] vowel.

(41)

	/píg + Cá/	$C_1$	$C_2$	$C_3$	$C_X$	$C_Y$	$C_Z$	LIC-[ATR]	IDENT([±ATR])
a.	píg-gá							*!	
☞	b. píg-gó								*
	c. píg-gá				*!		*!		*

(42) also shows progressive harmony but this time the spreading feature is [-ATR]. The form is *lubbò* ‘to follow.’ Regressive harmony is illicit in this case because the source of spreading is a [-hi] vowel.

(42)

	/lúb + Co/	$C_1$	$C_2$	$C_3$	$C_X$	$C_Y$	$C_Z$	LIC-[ATR]	IDENT([±ATR])
a.	lúb-bo							*!	
b.	lub-bo		*!						*
☞	c. lúb-bò								*

The next Tableau presents a situation in which root-suffix harmony actually improves the harmony of the root. *cúpá* ‘bottle’ is underlyingly disharmonic, and regressive spreading from the suffix to the root in *cúpání* ‘your bottle’ creates a fully harmonic word. Compare this Tableau with (35) above in which a harmonic root becomes disharmonic through suffixation. But *cúpání* is not optimal because it is fully harmonic. Rather, it wins because spreading from the suffix to the root violates none of the  $C$  constraints. Progressive [-ATR] spreading is ruled out by  $C_Z$  because the target is a [+hi] vowel. The other fully harmonic possibility, candidate (d), incurs one more violation of  $C_Z$  than candidate (c) and also violates  $C_X$ . Under the Licensing analysis, the fact that the optimal form in this case is fully harmonic is a coincidence, and rightly so because, as we’ve already seen, an analysis that takes complete harmony to be a goal fails to account for the cases of one-syllable spreading.



in *tòj-érê*. As I've argued, only Licensing predicts both of these. Two minor elements of the analysis change under Noonan's approach: The conditions that block harmony are different, so the constraints outranking LIC-[ATR] must change, and a low-ranking \*[-ATR] is needed to prevent [-ATR] from spreading. But \*[-ATR] cannot be ranked high enough to eliminate lax vowels altogether. Of course, the cases where [-ATR] spreads remain unexplained under this analysis, and therefore Smolensky's approach seems superior.

## 4.2 Benefactive Verbs

Benefactive verbs appear at first glance to cause problems for Licensing. Noonan (1992:142) gives the following paradigm to illustrate benefactive verbs with object suffixes:

(45)	a.	/ò-wìll-ì-á/	→	ò-wìll-á	'he bought it for me'
	b.	/ò-wìll-ì-í/	→	ò-wìll-í	'he bought it for you (sg)'
	c.	/ò-wìll-ì-é/	→	ò-wìll-é	'he bought it for him/her'
	d.	/ò-wìll-ì-wá/	→	ò-wìll-ì-wá	'he bought it for us'
	e.	/ò-wìll-ì-wùnù/	→	ò-wìll-ì-wùnù	'he bought it for you (pl)'
	f.	/ò-wìll-ì-wú/	→	ò-wìll-ì-wú	'he bought it for you (pl)'
	g.	/ò-wìll-ì-ú/	→	ò-wìll-ú	'he bought it for you (pl)'
	h.	/ò-wìll-ì-gí/	→	ò-wìll-ì-gí	'he bought it for them'

The morphemes in these forms are: /ò-/ 'he,' /wìllò/ 'buy' (which loses the stem-vowel ò when the benefactive suffix is added), /-ì/ 'benefactive,' /-á/ 'me,' /-í/ 'you (sg),' /-é/ 'him/her,' /wá/ 'us,' /wùnù/, /wú/, /ú/ 'you (pl),' /gí/ 'them.'

A suffixal *i* spreads [+ATR] to the root only in (45-b) and (45-g). In all other forms, the root vowel is lax. In (45-e) and (45-f), [+ATR] spreads from the second suffix to the first suffix but, unexpectedly for Licensing, not to the root. A noniterative rule unifies the behavior of (45-b) and (45-g) on one hand, and (45-e) and (45-f) on the other. The procedure is this: Locate the leftmost tense vowel and spread [+ATR] left once. Spreading targets the root in (45-b) and (45-g) because the source is immediately adjacent to the root. Spreading falls short of the root in (45-e) and (45-f) because the source of spreading is father from the root, and noniterative spreading leaves the root untouched. Licensing seems at a loss to explain why spreading stops short of the root in some cases but reaches the root in other cases in exactly the way a noniterative rule predicts. The forms in (45-e) and (45-f) seem to present a difficult challenge to the Licensing analysis developed above.

Fortunately, these forms are immediately accounted for by the Licensing analysis once a morphological idiosyncrasy is recognized. Each word in (45) contains the benefactive suffix /-ì/, which precedes the pronominal object suffixes. Noonan (1992:99) points out that this vowel deletes when it is followed by a vowel-initial morpheme: /téddò-ì-é/ becomes *téd'd-é* 'to cook for him/her,' for example. Deletion of the benefactive morpheme is apparent in (45-a), (45-c), and (45-g). It also happens in (45-b), where the surviving suffix must be the object suffix: this vowel has the object suffix's tone, and if the benefactive suffix survived in this case, there'd be no source of [+ATR] harmony. In all these cases, when the surviving

suffix is tense, [+ATR] spreads to the root as the Licensing analysis predicts.

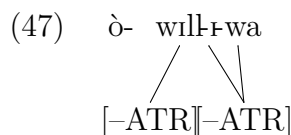
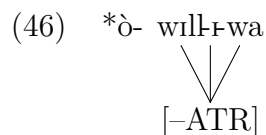
Significantly, the benefactive suffix is retained in all the cases where [+ATR] unexpectedly fails to spread to the root. Noonan (1992:98) explains that the benefactive /-ì/ never acquires a harmonizing feature from a root:  $\text{\textcircled{0}}\text{-n\`e}kk\text{-}\grave{\text{i}}$  ‘she killed it for’ does not become  $\text{\textcircled{0}}\text{-n\`e}kk\text{-}\grave{\text{i}}$ . One way to account for this is with an Alignment constraint requiring the left edge of the benefactive suffix to align with the left edge of an ATR domain. This constraint rules out configurations like (46), with an ATR feature straddling the left boundary of the benefactive suffix (but straddling the right boundary is permitted).

The forms in (45-e) and (45-f) show that the benefactive suffix additionally never permits spreading to the root.<sup>14</sup> When it acquires [+ATR] from a following suffix, it cannot pass this feature on to the root, exactly as the Alignment constraint predicts. This suffix forms a barrier that harmony cannot cross, so satisfying Licensing is impossible in (45-e) and (45-f), although spreading from the object suffix to the benefactive suffix reduces the number of unlicensed features. On the other hand, when the benefactive morpheme is deleted, this barrier is removed, and spreading can reach the root, as in (45-b) and (45-g).

Let’s consider each scenario in (45) individually. In  $\text{\textcircled{0}}\text{-will-}\grave{\text{i}}\text{-}\acute{\text{a}}$ / (45-a), the object suffix begins with a vowel, so the benefactive morpheme deletes. We’re left with  $\text{\textcircled{0}}\text{-will-}\acute{\text{a}}$ , which is already harmonic. The two [-ATR] features can coalesce, and Licensing is satisfied. The same thing happens in (45-c).

In  $\text{\textcircled{0}}\text{-will-}\grave{\text{i}}\text{-}\acute{\text{i}}$ / (45-b), the benefactive morpheme again deletes. [+ATR] can spread from the object suffix to the root to create  $\text{\textcircled{0}}\text{-will-}\acute{\text{i}}$ . The same thing occurs in (45-g).

In  $\text{\textcircled{0}}\text{-will-}\grave{\text{i}}\text{-w}\acute{\text{a}}$ / (45-d), the benefactive morpheme doesn’t delete because the object suffix begins with a consonant. The non-prefix vowels are already harmonic, but coalescence of these features (as in (46)) would violate the benefactive-specific Alignment constraint. Instead, (47) must be the correct output, with coalescence among only the suffixes to minimize Licensing violations. The same thing happens in (45-h).



In (45-e), [+ATR] can spread from the object suffix to the benefactive suffix, but spreading to the root is disallowed by the benefactive’s Alignment constraint. As with (47), spreading from one suffix to another leaves just one unlicensed feature. Licensing can’t be satisfied, but it can be minimally violated. The same thing happens in (45-f).

The Alignment constraint that produces the benefactive morpheme’s special behavior is another blocking condition on par with Smolensky’s  $\mathbb{C}$  constraints. Taking the benefactive ì’s idiosyncrasy into account, what looked like noniterative spreading is revealed to be spreading to the root where Licensing can be satisfied, and spreading among the suffixes to minimize Licensing violations where the benefactive morpheme prevents Licensing from being completely satisfied.

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<sup>14</sup>Presumably, Noonan didn’t note this himself because, e.g.,  $\text{\textcircled{0}}\text{-n\`e}kk\text{-}\grave{\text{i}}$  has regressive [-ATR] spreading which is ruled out independently.



Adding the relevant Faithfulness constraints to (50) would be counterproductive: Of the two winners in (50), the correct form is less faithful than the other.

(50)

	/bòŋó + ní/	IDENT[ATR]-[σ	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>X</sub>	C <sub>Y</sub>	C <sub>Z</sub>	AGREE
☞	a. b̀òŋó-ní								*
	b. b̀òŋó-ní						*!		
☞	c. b̀òŋó-ní								*
	d. b̀òŋó-ní	*!							*

Assuming this problem can be resolved, either by adding a lower markedness constraint that favors candidate (c) or by replacing AGREE with something like Alignment,<sup>16</sup> a more significant problem remains besides the one mentioned in connection with (49). IDENT[ATR]-[σ prevents us from producing the correct harmonic forms when the root is monosyllabic:

(51)

	/pí + wú/	IDENT[ATR]-[σ	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>X</sub>	C <sub>Y</sub>	C <sub>Z</sub>	AGREE
⊗	a. pí-wú								*
(☞)	b. pí-wú	*!							
	c. pí-wú						*!	*!	

Compare this Tableau with the Licensing-based Tableau in (52) immediately below. With a high-ranking Positional Faithfulness constraint, we now predict no harmony at all if minimal regressive spreading would alter the root-initial vowel and progressive spreading is blocked by the C constraints. This is obviously disastrous, as the correct form from the input in this case is pí-wú, with regressive harmony.

(52)

	/pì + wú/	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>X</sub>	C <sub>Y</sub>	C <sub>Z</sub>	LIC-[ATR]	IDENT([ATR])
	a. p̀ì-wú							*!	
☞	b. p̀ì-wú								*
	c. p̀ì-wú						*!		*

To correct this problem, we need yet another constraint outranking IDENT[ATR]-[σ that requires minimal spreading no matter what.<sup>17</sup> But this move clearly puts the Positional Faithfulness account in a bad position. The task of motivating harmony has been uneconomically divided between two constraints, AGREE and the minimal-spreading constraint. It is certainly preferable—on conceptual grounds at least—to consolidate the impetus for spreading in a single constraint.

<sup>16</sup>A constraint requiring ATR domains to be left-aligned in a word will favor candidate (c) over candidate (a): In the former, the [+ATR] domain is misaligned by one syllable, whereas it's misaligned by two syllables in the latter.

<sup>17</sup>Simply promoting AGREE won't work: The whole point of pursuing a Positional Faithfulness account was to provide a higher-ranking constraint that reins in AGREE.

Furthermore, the minimal-spreading constraint essentially reproduces the Licensing analysis. LICENSE-[ATR] motivates “minimal spreading no matter what” because it requires just enough spreading to ensure that the suffix’s ATR feature is also linked to the root. The Licensing account also tells us why such spreading is required: ATR features need a prominent host. Unless it adopts Licensing itself, the Positional Faithfulness account loses this insight.

In terms of its candidacy as a potential limiting factor of spreading in Lango, Positional Faithfulness must be rejected for several reasons. In sufficiently long roots, several root-initial vowels may be impervious to harmony, not just the first one. These data aside, Positional Faithfulness also requires a more complex analysis than Licensing. We need constraints to resolve the indeterminacy of (50) and to enforce minimal spreading in (51). In the end, a successful Positional Faithfulness account replicates the simpler Licensing analysis in effect but not in explanatory power. Licensing compares very favorably to Positional Faithfulness.

Once again, AGREE- and ALIGN-based analyses are unsuccessful. AGREE fails because, in the absence of complete harmony, it favors no harmony at all. ALIGN requires spreading of  $[\pm\text{ATR}]$  to the left edge of the root, and its effect must be curtailed by factors like Positional Faithfulness. Since an ALIGN-based analysis requires the additional machinery of Positional Faithfulness, it inherits the defects of Positional Faithfulness (except for the point mentioned in fn. 16) and must be discarded for the same reasons that doom Positional Faithfulness.

## 5.2 Optimal Domains Theory, Headed Spans, and Spread

Optimal Domains Theory (ODT; Cole & Kisseberth 1994, 1997, 1998, Cassimjee & Kisseberth 1998a,b) and Headed Spans McCarthy (2004) are theories whose goal is to eliminate the sour grapes problem. ODT separates the extent of a harmonic domain from the expression of the harmonizing feature within that domain. This means a disharmonic segment (i.e. a transparent vowel) may appear within a harmonic domain. In Headed Spans, certain segments are required to head harmonic domains of the feature  $[\alpha\text{F}]$ , and such segments block the propagation of  $[-\alpha\text{F}]$ . AGREE, Align, etc., are replaced with a constraint banning adjacent (and therefore a proliferation of) feature domains. Both theories are relevant here because they provide ways to mark certain segments as impervious to harmony.

Unfortunately, both ODT and Headed Spans block harmony on certain segments by appealing to feature co-occurrence restrictions or something similar. A segment fails to harmonize not because of its position in the word, but because constraints prevent segments with their featural configurations from acquiring the harmonizing feature. But as we’ve seen, position within the word is the crucial factor in Lango. All vowels may undergo harmony in principle, provided they’re either suffix vowels or root-final vowels. ODT and Headed Spans do not allow us to impose the right kinds of restrictions on harmony that Lango requires.

McCarthy (2004) notes that SPREAD (Padgett 2002, 1997, Walker 2000; see also Kaun 1995, who uses EXTEND rather than SPREAD) has roughly the same problems as Alignment. SPREAD encourages complete harmony by penalizing segments that aren’t linked to the appropriate feature value. Harmony can be blocked with feature co-occurrence constraints or Positional Faithfulness. Like other approaches that rely on these methods to prevent total harmony, SPREAD is not a viable foundation for an analysis of Lango.

### 5.3 Banning Disharmony

Pulleyblank (2002) proposes a novel way of achieving harmonic outputs. Rather than adopting constraints that encourage harmony, he proposes constraints that ban disharmony. Constraints of the form  $*[\alpha F][-\alpha F]$  militate against sequences of mismatched features in a way similar to the OCP's ban on adjacent matching features. Thus harmony is optimal because it minimizes mismatched features.

Lango requires both  $*[+ATR][-ATR]$  and  $*[-ATR][+ATR]$ . In consecutive syllables, vowels with mismatched ATR features are banned. Unfortunately, these constraints have the same sour grapes problem that plagues AGREE. Unless harmony is complete, one of these constraints will be violated just as if there were no harmony at all. Also, as with other theories and for exactly the same reasons, augmenting these constraints with Positional Faithfulness and feature co-occurrence constraints does not improve the analysis.

### 5.4 Self-Conjunction of IDENT

Armin Mester (p.c.) points out to me that the self-conjunction of IDENT[F] within an AGREE-style analysis would eliminate candidates in which the feature [F] is changed twice but permit a single segment to change its specification for [F]. That is, IDENT[ATR]<sup>2</sup> (=IDENT[ATR] & IDENT[ATR]) rules out  $*b\grave{\alpha}\eta\acute{o}-n\acute{i}$  but not  $b\grave{\alpha}\eta\acute{o}-n\acute{i}$  because only the former has two violations of IDENT[ATR]. Perhaps minimal spreading can be achieved with this constraint rather than with Licensing.

There are two reasons to dislike the self-conjunction approach, both mentioned by Mester. The first is conceptual. If IDENT[ATR]<sup>2</sup> is allowed, the conjunction of this constraint with IDENT[ATR] must also be allowed, yielding IDENT[ATR] & IDENT[ATR] & IDENT[ATR], or IDENT[ATR]<sup>3</sup>. The new constraint permits spreading through two syllables but not three. Yet another conjunction gives us IDENT[ATR]<sup>4</sup>, which permits spreading across three syllables but not four. Self-conjunction provides a way of counting syllables and permitting spreading by  $n$  syllables but not by  $n + 1$  syllables for any  $n$ . This is surely too powerful. Others have argued that phonological mechanisms must not have the power to count past two (McCarthy 2003), and self-conjunction of faithfulness constraints violates this limitation.

Second, IDENT[ATR]<sup>2</sup> predicts that just in case the root-final and suffix vowels are underlyingly harmonic, [+ATR] can spread to the penultimate root vowel because such a configuration would involve just one change in an ATR specification. This prediction is falsified by  $\grave{\alpha}pw\acute{o}'-n\acute{i}$  'your (sg) hare,' from  $\grave{\alpha}pw\acute{o}$  'hare.' Under the IDENT[ATR]<sup>2</sup> analysis,  $*\grave{\alpha}pw\acute{o}'-n\acute{i}$  should be the correct form because only one vowel's ATR specification has changed, so IDENT[ATR]<sup>2</sup> cannot force a violation of AGREE. In contrast, the Licensing analysis predicts  $\grave{\alpha}pw\acute{o}'-n\acute{i}$  because sharing a [+ATR] specification with the root-final vowel prevents the suffix vowel from violating LICENSE-[ATR] even though no spreading occurs.<sup>18</sup>

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<sup>18</sup>Self-conjunction also predicts that only one vowel of a disyllabic suffix may harmonize. This is falsified by (36), although limiting the conjoined constraints to holding only for root vowels (i.e. IDENT[ATR](Root)<sup>2</sup>) can accommodate these forms by imposing no faithfulness requirement on affixes.

## 5.5 Summary

This section has examined a number of analyses that the Licensing analysis promoted here must compete with. All the rival approaches are faulty in some way and must be rejected. Only Licensing achieves both explanatory and descriptive adequacy.

This is not to say that any of the alternatives should be ejected from phonological theory altogether. Each may prove essential in one way or another, but only Licensing can account for harmony in Lango, and therefore any phonological theory must at least incorporate Licensing regardless of whatever other theoretical mechanisms it adopts.

## 6 Other Cases of Noniterativity

Lango is not the only language that exhibits phenomena that appear to be (non-trivially) noniterative. In this section I discuss some of these other phenomena and argue that they, too, can be accounted for without a formalization of noniterativity. A detailed investigation of these and other cases has two goals: (i) All potential cases of noniterativity must be examined to determine conclusively whether or not noniterativity plays a formal role in phonology, and (ii) if noniterativity really is epiphenomenal, it will be useful to have a typology of the factors that can conspire to create noniterativity. One such factor that was argued for above is attraction to prominence, but there may well be many others. With these goals in mind, I plan to undertake a survey of noniterative phenomena. The discussion in this section is just the beginning of this survey.

### 6.1 Metaphony in Tudanca Spanish

In Tudanca Spanish (Flemming 1994, Walker 2004), laxness spreads regressively from word-final vowels to the stressed vowel. High vowels are obligatorily lax word-finally (Walker 2004). Following Flemming and Walker, capitalization indicates laxness (i.e. [-ATR]) and diacritics mark stress:


(53)	a.	p <sup>í</sup> ntU	‘male calf’	p <sup>í</sup> nta	‘female calf’
	b.	s <sup>é</sup> kU	‘dry (masc.)’	séka	‘dry (fem.)’
	c.	θ <sup>ú</sup> rdU	‘left-handed (masc. sg.)’	θúrdos	‘left-handed (masc. pl.)’
	d.	ÓhU	‘eye (sg.)’	óhos	‘eye (pl.)’
	e.	sekÁU	‘to dry him’	sekálo	‘to dry it (mass)’
	f.	ahambrÁU	‘hungry (masc.)’	ahambráa	‘hungry (fem.)’
	g.	antigw <sup>í</sup> lsImU	‘very old’		
	h.	orÉgAnU	‘oregano’		
	i.	p <sup>ó</sup> rtIkU	‘portico’		
	j.	rak <sup>í</sup> ItIkU	‘rachitic’		
	k.	kÁrAbU	‘tawny owl’		
	l.	p <sup>ú</sup> lpItU	‘pulpit’		

Flemming adopts the view that Spanish has a word-final trochee plus, in some cases, an extrametrical syllable. [-ATR] (or [-tense] for Flemming) spreads from the word-final vowel to the stressed syllable. Since extrametrical syllables are adjoined to the final foot in Flemming’s theory, he argues that spreading is confined to the foot (in OT terms, we might use ALIGN(L,[-ATR];Ft,L)). Walker views the above assimilations as spreading to the stressed vowel and proposes a Licensing analysis in which [-ATR] must be linked to the stressed syllable. Under either analysis, what might otherwise be analyzed as noniterative spreading is actually either exhaustive spreading within a small domain (the foot) or spreading to a prominent position. Although (53-a)–(53-f) appear to contain noniterative spreading, (non)iterativity doesn’t enter the discussion.

To arbitrarily adopt Walker’s characterization of Tudanca Spanish, a licensing constraint like the one in (54) is sufficient to motivate metaphony. (This is a simplified version of Walker’s analysis.) “Noniterative” spreading satisfies Licensing when the stressed syllable is penultimate (and therefore adjacent to the syllable containing the lax vowel). When a syllable intervenes between the stressed and word-final syllables, spreading through the intervening vowel is required if the [-ATR] feature is to reach the stressed vowel. In neither case is spreading beyond the stressed vowel a possibility. This is illustrated in (55). Like Lango’s harmony, the extent of spreading varies with the distance between the source vowel and the target prominent position.

(54) LICENSE-[-ATR]/Stress: [-ATR] must be linked to a segment in a stressed syllable.

(55)

/oréganu/	*[+high, +ATR] <sub>Wd</sub>	LICENSE-[-ATR]/Stress	IDENT([±ATR])
a. oréganu	*!		
b. orégAnU		*!	*
 c. orÉgAnU			**
d. OrÉgAnU			***!

Candidate (a) is ruled out by the ban on [+ATR] high vowels in word-final position. The remaining candidates have a [-ATR] final vowel, but only candidates in which this feature spreads to the stressed vowel avoid violations of LICENSE-[-ATR]/Stress (candidates (c) and (d)). Of these, the winner is the one that incurs the fewest violations of IDENT([±ATR]). In forms with penultimate stress, this will be the form in which [-ATR] has spread exactly one syllable, but when there is antepenultimate stress, as in (55), spreading cannot be characterized as noniterative under any theoretical framework. Metaphony in Tudanca Spanish joins Lango’s assimilation as a phenomenon that involves minimal spreading to license particular features. Both cases argue against viewing assimilatory phenomena in terms of iterativity because some configurations in each language require ostensibly noniterative spreading and others require what looks like iterative spreading. The two sets can only be unified under an analysis that takes the target, not the extent, of spreading to be the crucial factor. The appearance of iterativity or noniterativity is not analytically significant.

Many other languages exhibit attraction-to-stress phenomena. Some that are relevant to questions of noniterativity are discussed here. As it happens, Lango is one of these languages.

## 6.2 Fast-Speech Licensing: Attraction to Stress

Noonan (1992:32, 79) notes that in fast speech, harmony does not have to stop with the root-final syllable. It may optionally extend into the root-penultimate syllable:

- (56)
- |    |                         |                         |
|----|-------------------------|-------------------------|
| a. | b̀̀̀̀́-ńí ~ b̀̀̀̀́-ńí   | ‘your (sg) dress’       |
| b. | b̀̀̀̀́-wú ~ b̀̀̀̀́-wú   | ‘your (pl) dress’       |
| c. | p̀̀̀̀́-ńí ~ p̀̀̀̀́-ńí   | ‘your (sg) knife’       |
| d. | p̀̀̀̀́-wú ~ p̀̀̀̀́-wú   | ‘your (pl) knife’       |
| e. | òkwé'cé-ńí ~ òkwé'cé-ńí | ‘bitches’ <sup>19</sup> |

Why would [+ATR] spread an extra syllable in these cases? And why is this limited to fast speech? I suggest the answers to these questions are related. First, it is important to note that the root-initial vowels that are optionally targeted in (56) are all explicitly marked as stressed by Noonan. Also, Noonan (1992:71) shows that the second vowel of a disyllabic stem is optionally deleted under suffixation. Thus *b̀̀̀̀́-ná* ‘my dress’ may be rendered as *b̀̀̀̀́á*. Deletion of this sort often accompanies unstressed, prosodically weak vowels, and it is no surprise that it shows up in fast speech, where unstressed vowels may be severely reduced. Consequently, a root vowel may not necessarily be sufficiently prominent to license ATR features in fast speech. In speech styles where otherwise prominent segments can be reduced or deleted, Licensing imposes stricter standards, in this case requiring [ $\pm$ ATR] to be linked to a stressed vowel, not just a root vowel. Thus the extra spreading seen in (56) isn’t spreading by one extra syllable as Noonan implies but is instead spreading to the stressed vowel, which happens to be just one syllable beyond the normal edge of the harmony domain.

Evidence that this is correct comes from the fact that no alternate form *\*ìc̀̀̀́-kí* accompanies *ìc̀̀̀́-kí* ‘your (sg) sweet potato,’ even though this form is given in the same data set (p. 79) in which Noonan provides the alternations in (56). Presumably, this is because *\*ìc̀̀̀́-kí* is not a possible fast-speech variant. And as the attraction-to-stress analysis predicts, *ìc̀̀̀́-kí* has stress on *o*, not the initial *ɪ*. Likewise, *ìm̀̀̀́-í* ‘your (sg) liver’ (30-f) has no variant *\*ìm̀̀̀́-í* (p. 81), and the underlying *a* (which surfaces as  $\text{ə}$ ) is marked as stressed. Requiring spreading to the stressed vowel in these cases gives the same result as requiring spreading to the root, but permitting harmony by one extra syllable permits the incorrect *\*ìc̀̀̀́-kí* and *\*ìm̀̀̀́-í*. These examples also show that the fast-speech extra spreading cannot be accounted for in phonetic terms, for example by enforcing spreading by some number of milliseconds that encompasses two vowels in fast speech but only one vowel in normal speech. As *ìc̀̀̀́-kí* and *ìm̀̀̀́-í* demonstrate, spreading an extra syllable is conditioned not just by faster articulation but also by stress placement.

Noonan doesn’t give any forms that rule out total spreading in fast speech, but *ìc̀̀̀́-kí* suggests that total spreading is an incorrect analysis. It’s not clear why a change in stress placement would suppress total spreading. Instead, this form deviates from the normal pattern just as the attraction-to-stress analysis predicts. But in case fast speech does induce

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<sup>19</sup>Note that the initial vowel in this form is underlyingly [+ATR] so the fast-speech extra spreading variant does not show spreading by an extra two syllables.


total spreading, there is still no need to invoke (non)iterativity. A fast-speech-only AGREE or something similar can produce complete harmony in these cases.

To incorporate the attraction-to-stress variants into the Licensing analysis, we need the constraint in (57). Without detailed evidence of its ranking, I assume fast-speech harmony is subject to the same conditions as “regular” harmony and rank (57) alongside LICENSE-[ATR].

- (57) LICENSE-[ATR]/Stress (fast speech): In fast speech, [ $\pm$ ATR] features must be linked to stressed vowels.

The Tableau in (58) shows the evaluation of the fast-speech form *bòŋó-ní* ‘your (sg) dress’ (cf. (35)). The crucial comparison is between candidates (b) and (c). In (35), which illustrated for the normal-speech version of this word, candidate (b) was optimal because it satisfied LICENSE-[ATR] while minimally violating IDENT[ $\pm$ ATR]. With LICENSE-[ATR](fast speech) active in (58), this form is no longer optimal. Regressive spreading must reach the first (stressed) syllable to satisfy the new licensing requirement, even though this incurs an extra Faithfulness violation. Progressive spreading as in candidate (d) incurs just one IDENT[ $\pm$ ATR] violation, but this is ruled out by the higher-ranked  $\mathbb{C}_Z$ . Naturally, the evaluation in (35) is not affected by the new Licensing constraint because that Tableau does not involve fast speech and LICENSE-[ATR](fast speech) assigns no violations to the candidates.

- (58)

/bòŋó + ní/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	LIC-[ATR]	LIC (fast)	IDENT
a. 'bòŋó-ní							*!		
b. 'bòŋó-ní								*!	*
 c. 'bòŋó-ní									**
d. 'bòŋó-ní						*!			*

The fast-speech data discussed here provide more evidence that ATR harmony in Lango is driven by licensing considerations. A suffix’s [+ATR] feature encroaches further upon root vowels in fast speech than in normal speech, but it still has a prominent vowel as its target. This being the case, noniterativity remains irrelevant to the analysis.

### 6.3 Umlaut

Historically, Germanic umlaut (McCormick 1981, van Coetsem & McCormick 1982) spread [-back] from suffix vowels to the root-final vowel. While this seems to require spreading of [-back] one vowel to the left and no farther, McCormick (1981) has argued that Germanic umlaut is actually prosodically constrained: The root-final vowel is prosodically prominent while the suffix vowel is reduced, suggesting the presence of a word-final trochee. [-back] spreads throughout the foot, much like (Flemming’s (1994) description of) ATR harmony in Tudañca Spanish. Only one vowel is targeted because there are only two vowels in the foot. Alternatively, a Lango-style Licensing analysis possible, with [-back] spreading to the root for licensing purposes. Again, no mention if iterativity is necessary.

Chamorro umlaut (Topping 1968, Chung 1983) involves progressive spreading of [-back] from “certain particles and affixes” (Chung 1983:44) onto the vowel in the next syllable if the target vowel is stressed:

- (59)
- |    |        |                 |          |  |
|----|--------|-----------------|----------|--|
| a. | nána   | ‘mother’        | i nána   | ‘the mother’                               |
| b. | káтта  | ‘letter’        | ni káтта | ‘letter’                                   |
| c. | húŋuk  | ‘to hear’       | in-híŋuk | ‘we (excl.) heard’                         |
| d. | púgas  | ‘uncooked rice’ | mí-pìgas | ‘abounding in uncooked rice’ <sup>20</sup> |
| e. | sóŋsuŋ | ‘village’       | i séŋsuŋ | ‘the village’                              |

As with Tudañca Spanish, this is clearly attraction to stress, not blind spreading by one syllable. Confirmation comes from forms like (60) in which the syllable after the definite article *i* is not stressed and umlaut therefore does not occur. As Jaye Padgett (p.c.) pointed out to me, an analysis like the ones proposed above for Tudañca Spanish and fast-speech Lango is appropriate here as well, and iterativity again plays no role.

- (60)
- |    |          |                 |            |                     |
|----|----------|-----------------|------------|---------------------|
| a. | pulónnun | ‘trigger fish’  | i pulónnun | ‘the trigger fish’  |
| b. | mundóŋgu | ‘cow’s stomach’ | i mundóŋgu | ‘the cow’s stomach’ |

## 6.4 Emphatic Spread in Arabic

In Northern Palestinian Arabic, emphasis (= [RTR]) spreads leftward from the underlyingly emphatic consonant to the beginning of the word and rightward to the next syllable nucleus following the underlyingly emphatic consonant (Davis 1995, McCarthy 1997; following the latter, capitalization marks underlying emphasis and underlining marks emphatic spread):

- (61)
- |    |                 |                                |
|----|-----------------|--------------------------------|
| a. | <u>man</u> Taka | ‘area’                         |
| b. | ʔa <u>D</u> lam | ‘most unjust’ ( $D = \delta$ ) |
| c. | <u>S</u> naaf   | ‘brands’                       |
| d. | <u>S</u> abaah  | ‘morning’                      |

A noniterative rule could easily be written to spread [RTR] from any segment to the next low vowel and through the intervening segments. While it is true that [RTR] can continue spreading rightward through a sequence composed of laryngeals, pharyngeals, and *a* (the “low” segments) as shown in (62), the additional spreading shown there is blocked by non-low segments whereas spreading to the first *a* (61) is blocked only by [+hi] segments. The different blocking segments indicate that two spreading operations are at work. The first spreads [RTR] noniteratively to the next low nucleus through any nonhigh segments, and the second spreads [RTR] iteratively through only low segments. Davis (1995) proposes a rule-based account that does just this, except that he derives noniterative spreading through an iterative rule whose domain of application is limited to the following syllable nucleus.

- (62) a. maSlaħa ‘interest’

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<sup>20</sup>Umlaut only optionally targets secondarily stressed segments, so this form has an alternative: *mí-pùgas*.

- b. Sahhaha      ‘he awakened her’
- c. Sahan        ‘he ground’
- d. Sahhab      ‘he leveled a layer of small stones’
- e. Taaʃan       ‘he stabbed repeatedly’

But McCarthy (1997) shows that the noniterative nature of the first spreading operation can be produced with an Alignment constraint requiring the right edge of an [RTR] domain to align with *a*. Outranked by \*[RTR, +hi], this constraint motivates spreading through all segments except ones that are [+hi]. The spreading in (62) is motivated by a low-ranking constraint requiring [RTR] to align with the right edge of the word. Its effect is curtailed by a constraint against nonlow [RTR] segments.

A Positional Licensing analysis for these data is also imaginable. Apparent noniterative spreading to the next low vowel can be motivated by a constraint stating that [RTR] is licensed only on low vowels. This would have to be formulated as a COINCIDE (Zoll 1998a, Itô & Mester 1999) constraint requiring the *right edge* of an [RTR] domain to be licensed by *a*. Otherwise leftward spreading that happens to include *a* in its domain (as in (61-a)) would obviate the need for rightward spreading. Crucially, the noniterative appearance of the spreading in (61) can be characterized in iterativity-neutral terms.

## 6.5 Tone

The tonal literature is rife with examples of tones that spread or move one syllable from their underlying host. While these phenomena have received attention in the OT literature (see especially Myers (1997)), more work is needed to understand the nature of the phonological considerations that motivate them. To give just one example, in Kikuyu verbs, high tones (H) appear one syllable to the right of the morphemes that introduced them (Clements 1984; the morphemes that supply the high tones are underlined):

- |      |    |                |                      |                         |                   |
|------|----|----------------|----------------------|-------------------------|-------------------|
| (63) | a. | to-rɔr-aɣ-a    | ‘we look at’         | to- <u>tom</u> -áɣ-a    | ‘we send’         |
|      | b. | to-mo-rɔr-aɣ-a | ‘we look at him/her’ | to- <u>ma</u> -rɔr-áɣ-a | ‘we look at them’ |
|      | c. | to-rɔr-ir-é    | ‘we looked at’       | to- <u>tom</u> -ír-é    | ‘we sent’         |

The line of reasoning pursued in this paper leads us to ask whether the movement illustrated in (63) might be symptomatic of well-formedness conditions that don’t directly require spreading and movement. A detailed investigation of these and other cases must be undertaken with this in mind. Can these phenomena be characterized in terms of attraction to prosodic or morphological prominence (a la de Lacy 1999), or in terms of attraction to syllables with particular segmental configurations (to name two salient possibilities)? Another alternative is that apparent noniterative tonal phenomena arise from (or are phonologizations of) delayed realization of pitch targets<sup>21</sup> as surmised by Myers (1999, 2003) rather than spreading and movement *per se*. Although this line of reasoning is a plausible explanation for the development of these systems, it does little to suggest a synchronic formalization of

<sup>21</sup> “Peak delay” (Silverman & Pierreumbert 1990); See also Myers (1999) and research cited therein.

the phonologization.

Myers (1997) proposes the constraint LOCAL to account for one-syllable tone shift in Rimi similar to that found in Kikuyu. LOCAL requires tone-bearing units for corresponding tones to be adjacent, so an output tone cannot surface on a syllable that is not adjacent to the syllable that the input tone was linked to. The appearance of noniterative displacement is therefore derived through constraints on locality, not through a single application of some mechanism that requires shifting. Although this has the appearance of grafting noniterativity onto OT, the insights that (can be surmised to) underly LOCAL suggest avenues that can be pursued in developing a robust analysis of tone spread/shift. Perhaps the adjacency required by LOCAL facilitates information recovery: If all tones appear  $n$  units away from the morphemes that they belong to, it is very easy to determine a tone's morphological affiliation. Under iterative tone movement (but not spreading), neutralization renders this reconstruction impossible: All tones will surface on the final syllable of a word no matter which morphemes they come from. LOCAL may also reflect a form of CONTIGUITY-satisfaction: With noniterative tone shift/spread, no tones or segments fall between the segments of a morpheme and the tone that spreads away from these segments, as (64) shows schematically.

$$(64) \quad \begin{array}{ccccccc} & L & L & \boxed{H} & L & & \\ & & \boxed{\text{tom-}} & & \text{a}\gamma\text{-} & \text{a} & \\ \text{to-} & & & & & & \end{array}$$

With more investigation, some cases of apparent noniterative shift/spread may be revealed to have a noniterative nature only in certain situations. For example, in Shona (Myers 1987, 1997), high tones spread from one syllable to the next as long as a morpheme boundary falls between these syllables (again, tones' sources are underlined):

- (65) a. í-sádzá  
 copula-porridge  
 '(it) is porridge' (cf. *sadzá* 'porridge')
- b. ti-chá-véreng-a  
 1pl-future-read-term  
 'we will read' (cf. *ku-vereng-a* 'to read')

At first glance, this could easily be analyzed with a noniterative rule that requires a morpheme boundary between the source and target, but as (66) shows, this would be misguided. The high tone can continue to spread from syllable to syllable as long as morpheme boundaries fall between each syllable. Like harmony in Lango, the seemingly noniterative nature of the phenomenon disappears when more data are considered.

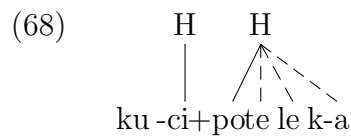
- (66) a. Vá-má-zí-mí-chéro  
 2a-6-21-4-fruit  
 'Mr. Big-ugly-fruits' (cf. *ma-zi-mi-cheró* 'Big, ugly fruits' (Myers 1997:862ff, citing Odden 1982:83))

See Myers (1997) for an analysis of this spreading. Myers reins in spreading with BOUND, which requires successive syllables in a tonal domain to be in different morphological domains. Spreading within a morpheme violates BOUND, but spreading across morpheme boundaries does not.

Yet another application of noniterative rules is in combination with other rules to produce complex tonal patterns that do not exhibit any noniterative character on the surface. For example, Hyman & Mathangwane (1998) make use of three rules of high tone spreading (HTS) to account for the tonology of verb stems in Ikalanga. Two of these rules are noniterative, but, as (67) shows, tones do not simply spread by one syllable.<sup>22</sup>

- (67)
- |    |                         |                           |
|----|-------------------------|---------------------------|
| a. | ku-cí+pótélék-á...      | ‘to surround it...’       |
| b. | ku-cí+fúmík-á bu-sîkú   | ‘to cover it at night’    |
| c. | ku-cí+táfún-á bu-sîkú   | ‘to chew it at night’     |
| d. | ku-cí+bákílíl-á bu-sîkú | ‘to fence it in at night’ |
| e. | ku-cí+pótélék-á bu-sîkú | ‘to surround it at night’ |
| f. | ku-cí+túm-á bú-sî:kú    | ‘to send it at night’     |

The symbol ‘+’ marks the boundary between prefixes and the verb stem. In each example, H links to the first syllable of the stem and spreads rightward as illustrated in (68) for (67-a).



H spreads throughout the stem, and in the case of (67-f), H spreads also to the first syllable of the next word, *bu-sîkú* ‘at night.’ All disyllabic and shorter stems (henceforth “short stems”) exhibit spreading to the next word:

- (69)
- |    |                  |                       |
|----|------------------|-----------------------|
| a. | ku+ch-á bú-sîkú  | ‘to fear it at night’ |
| b. | ku+tól-á bú-sîkú | ‘to take it at night’ |

The derivational analysis of HTS proposed by Hyman & Mathangwane (1998) works like this. H is linked to the stem-initial syllable. The first rule, HTS<sub>1</sub>, spreads this H one syllable to the right. In the case of short stems, this means the domain of H already encompasses the entire stem. Next, the final syllable of the stem is declared extrametrical (i.e. impervious to further HTS). HTS<sub>2</sub> then spreads H iteratively to the end of (the visible portion of) the stem. HTS<sub>2</sub> applies vacuously in short stems (HTS<sub>1</sub> already exhausted the available stem syllables), but in longer stems the result is that all but the last syllable of the stem is linked to H. Finally, extrametricality is removed, and HTS<sub>3</sub> spreads H one more syllable to the right. This last rule has two effects: (i) It links H to the previously extrametrical stem-final syllables in longer stems, and (ii) it spreads H from the final syllable of short stems to the

<sup>22</sup>All forms discussed here are crucially internal to Intonational Phrases. IP-final verbs show some complications that do not concern us here. See Kaplan (2006a,b) for a treatment of these forms in OT.

first syllable of the next word. Two representative derivations are given in (70).

	/ku-cí+pótelek-a (bu-sîkú)/	/ku-cí+túm-a (bu-sîkú)/	
	HTS <sub>1</sub> ku-cí+pótelek-a (bu-sîkú)	ku-cí+túm-á (bu-sîkú)	
(70)	Extrametricality ku-cí+pótelek-<a> (bu-sîkú)	ku-cí+túm-<á> (bu-sîkú)	
	HTS <sub>2</sub> ku-cí+pótélék-<a> (bu-sîkú)		
	HTS <sub>3</sub> ku-cí+pótélék-á bu-sîkú	ku-cí+túm-á bú-sîkú	

There is nothing noniterative about HTS in these examples. The only reason Hyman & Mathangwane employ noniterative rules in the forms under discussion is to account for the spreading of H to the next word in short stems. Clearly the surface generalization is that H spreads throughout the stem plus one more syllable in the case of short stems. A simple ALIGN-R constraint or something similar is enough to account for the spreading throughout the stem, and constraints imposing a minimum limit on the breadth of high-tone domains can motivate the “extra” spreading in short stems. See Kaplan (2006a,b) for an analysis along these lines. The noniterativity in Hyman & Mathangwane’s analysis is simply an artifact of their derivational approach. Nothing in the data above demands a noniterative treatment. Thus we see another way in which iterativity can seem relevant from a rule-based perspective. This impression disappears in the light of OT’s orientation toward outputs rather than processes.

As this section shows, a range of seemingly noniterative phenomena can be accounted for in ways that do not require iterativity as a formal construct. These phenomena are grounded in other factors that derive the appearance of noniterativity. In light of these facts, it is not unreasonable to suppose that all such noniterative phenomena can be analyzed in similar ways, although clearly more work is needed. If this hypothesis holds up, it casts suspicion on the iterativity parameter common to many rule-based theories. If iterativity is not a genuine property of phonological phenomena, why do we need an iterativity parameter in our theory? In contrast, the fact that OT has more difficulty adopting the simple iterative/noniterative formal dichotomy of rule-based theories turns out to be a benefit: The appearance of noniterativity should result from other factors coming to bear on phenomena because, as the examples above show, these other factors are demonstrably active. Analyses that hinge on iterativity are ubiquitous in phonology, but, if the cases discussed here are indicative, noniterativity itself is an illusion.

The phenomena discussed here fill in some of the typology of factors that create the appearance of noniterativity. Attraction to prominence recurs regularly (Lango, Chamorro, Tudanca Spanish under Walker (2004), fast-speech Lango, Sanskrit, Arabic), as does complete spreading within a small domain (Tudanca Spanish under Flemming (1994), German).

## 7 Conclusion

This paper has developed an analysis of ATR harmony in Lango grounded in Positional Licensing. In Lango, harmony holds between root-final and suffix vowels. Standard harmony-

driving constraints like AGREE and ALIGN cannot produce the pattern found in Lango, which appeared initially to require constraints favoring spreading by exactly one syllable in a way that mimics noniterative assimilation rules. But this unattractive solution is inferior to the Positional Licensing analysis, both empirically and explanatorily. In addition to generating the correct surface forms, the Licensing analysis sheds light on why minimal harmony might be desirable. In the case of Lango, minimal harmony places suffix ATR features in a prominent position, namely the root. The contrast between [+ATR] vowels and [-ATR] vowels is made more salient in this way. A survey of other potential analyses of Lango revealed that Licensing is the superior account both empirically and conceptually.

Kinande, whose harmony system looked at first like Lango’s iterative counterpart, is fundamentally different from Lango. Evidence shows that Lango’s harmony is driven by a need to place ATR features in the prominent position of a root. But attraction to prominence cannot be the motivating factor in Kinande, where ATR features spread from prominent roots to less prominent affixes. The two harmony systems are not siblings driven by the same motivation while arriving at different results. Even their motivations must be different.

To return to the juxtaposition of rule-based theories against OT with respect to iterativity, the prospect of noniterative harmony is not welcome from the point of view of OT. OT cannot differentiate between iterative and noniterative phenomena with a simple switch of a parameter the way rule-based theories do. But examining closely what looked like a case of noniterative assimilation in Lango, we saw that noniterativity was an emergent property of the grammar, and the constraint system does not need to explicitly recognize the noniterative nature of the harmony system. An initial look at other apparently noniterative phenomena in other languages suggests that Lango is not alone in requiring no mention of noniterativity in the production of seemingly noniterative phenomena. The conclusion that noniterativity is really an emergent property, if upheld, casts an unfavorable light on theories of phonology that adopt noniterativity as an important construct, while the lack of a formalization of noniterativity in OT is suddenly appealing.

There are several possibilities for development of this research in the future. Perhaps the most obvious direction is the typological survey. I have identified many potential cases of noniterativity, some of which are mentioned above, and I am currently searching for more phenomena. The analysis of Lango also needs improvement. As many people have pointed out to me, a configuration that can definitively test the Licensing analysis is one in which [+ATR] spreads regressively from a suffix vowel that is not adjacent to the root. E.g., an input like /bɔŋɔ-na-ni/ should yield *bɔŋɔ-nə-ni*. So far I have not found a form with the appropriate configuration. Another prediction, pointed out to me by Kazutaka Kurisu (p.c.), is that there should be a language with “edge-in” harmony: /i-mɔtɔkə-e/ should be realized as *i-mɔtɔkə-e*, for example, with spreading from both prefixes and suffixes to satisfy Licensing. I know of no such language (Lango doesn’t have this spreading because prefixes don’t harmonize), but the prediction does not seem unreasonable. It is roughly just a combination of Lango’s assimilation and Chamorro’s umlaut. Finally, there are a few examples in Lango that do not conform to Smolensky’s C constraints, and these present an opportunity to improve upon Smolensky’s account.

For example, *o-nɛn-o-wu* ‘he/she saw you (pl)’ has no spreading to the root. Spreading from *o* to the root is correctly blocked by Smolensky, but spreading from *u* to *o* and then to the root is not: *u*, being the ultimate source of spreading, is an acceptable head of a [+ATR] domain in Smolensky’s theory. Since spreading is blocked in large part based on the resulting head of the harmonic domain, Smolensky cannot block spreading from *u*. But since *o* must be prevented from being a source of harmony on independent grounds, we can correctly produce *o-nɛn-o-wu* by referring to acceptable sources of spreading rather than acceptable domain heads. *o* is an unacceptable source of spreading, even though it is not the domain head. This requires a conception of spreading in which the spreading feature moves from one segment to the next sequentially rather than from the first segment to all targets at once. Such a position has been promoted by Vago (1973) and Kiparsky (1985).

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