CHAPTER 2

Vowel Harmony in Lango

2.1 Introduction

Vowel harmony in Lango, a Nilotic language spoken in Uganda, spreads [+ATR] from suffix vowels to the root-final vowel:

(1) a. /bɔ̀ŋɔ́-nɪ́/ → bɔ̀ŋɔ́nɪ́ 'your dress'
b. /cɔ̀ŋɔ̀-nɪ́/ → cɔ̀ŋɔ̀nɪ́ 'your beer'
c. /àmʊ́k-nɪ́/ → àmúkkɪ́ 'your shoe'

Lango's harmony presents the strongest argument for the existence of true noniterativity in segmental phonology that I am aware of. This chapter argues that this noniterativity is illusory: The assimilation shown in (1) is not truly noniterative, and it therefore does not refute the Emergent Noniterativity Hypothesis. Rather than reflecting a requirement that [+ATR] spread exactly once, Lango's harmony is driven by an imperative to spread [+ATR] from the suffix to the root. Since spreading just one syllable leftward satisfies this demand, no further assimilation is motivated.

In rule-based theories such as autosegmental phonology (Goldsmith 1976) and Grounded Phonology (Archangeli & Pulleyblank 1994), the spreading in (1) is easily captured with a noniterative rule like the one in (2), which spreads [+ATR] regressively from one vowel to the preceding vowel.

(2) V C_0 V Iterativity Parameter: OFF

[+ATR]

This contrasts with more familiar cases of vowel harmony in which the harmonizing feature spreads throughout the domain of harmony in an iterative fashion. For example, in Kinande (Archangeli & Pulleyblank 1994, Cole & Kisseberth 1994), verbal prefixes harmonize with root ATR specifications (*a* is invariant and transparent and roots are italicized):

(3)

a.	/E-rI-*lib*-a/	→ ɛriliba	'to cover'[1]
b.	/tU-ka-kI-*lim*-a/	→ tukakilima	'we exterminate it'
c.	/E-rI-*huk*-a/	→ ɛrihuka	'to cook'
d.	/tU-ka-kI-*huk*-a/	→ tukakihuka	'we cook it'
e.	/E-rI-*lɪm*-a/	→ ɛrılıma	'to cultivate'
f.	/tU-ka-kI-*lɪm*-a/	→ tʊkakılıma	'we cultivate it'
g.	/E-rI-*hʊm*-a/	→ ɛrıhʊma	'to beat'
h.	/tU-ka-mU-*hʊm*-a/	→ tʊkamʊhʊma	'we beat him'

Setting aside the transparency of *a* and the fact that [–ATR] spreads in Kinande, 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 (see Chapter 1). The same rule from (2) can account for Kinande if the iterativity parameter is switched on.

[1]Archangeli & Pulleyblank (1994) state that the *E-* prefix is outside the domain of lexical harmony and is optionally harmonized postlexically.

Accounting for Lango's harmony is simple from a rule-based perspective, but as explained in Chapter 1, Lango presents OT with two related difficulties. First, OT cannot produce noniterativity in general, so if Lango's harmony is truly noniterative, it presents a strong challenge to OT's parallel framework. Second, OT cannot account for Lango and Kinande with analyses that differ only in the setting of a parameter. Thus if we accept the premise that these are related harmony processes, OT loses this insight. To illustrate, we might account for Kinande's harmony with the AGREE constraint in (4).

(4) AGREE-[±ATR]: Vowels in adjacent syllables must have the same value for [±ATR].

AGREE-[±ATR] produces spreading throughout a word because without complete harmony, there will necessarily be adjacent mismatched vowels somewhere in the word. But since iterativity is not explicitly mandated by the constraint, it cannot be switched off in any easy way to transform the analysis of Kinande into an analysis of Lango. The issue of noniterativity aside, then, OT cannot formalize the similarity between these two harmony processes.

I claim in this chapter that 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 (Crosswhite 2000, Itô 1988, Itô & Mester 1994, 1999, Steriade 1994a,b, 1995a, Walker 2001, 2004, Zoll 1997, 1998a,b). In the same way the harmonizing feature in Tudanca Spanish is attracted to the stressed syllable (Walker 2004; see also Chapter 1), the driving force behind Lango's har-

mony is a need for suffix ATR features to be linked to a prominent position, namely the root. The noniterativity of Lango's harmony is coincidental: In each example 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, and Positional Licensing is not merely a convenient crutch that masks OT's shortcomings. The rule-based approach is empirically inadequate.

The Positional Licensing analysis of Lango is therefore the first piece of the argument that noniterativity does not have a place in phonology. At best noniterativity is a descriptive label we can apply when grammatical factors conspire to produce certain patterns. The seemingly 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.

The process involved in Lango's harmony is secondary to the motivation for spreading, namely root-licensing. Once that motivation is formalized, the process—noniterative spreading—comes for free: it is an emergent rather than

primitive property of Lango's harmony.

The chapter is structured as follows: §2.2 gives a more detailed picture of Lango's harmony. §2.3 develops the Positional Licensing analysis, which builds on Walker (2004) and Smolensky (2006). §2.4 considers alternatives to Positional Licensing and argues against them, and §2.5 presents evidence in support of the Positional Licensing analysis in the form of data from harmony in fast speech. §2.6 briefly turns to the language Akposso, in whose harmony system support for the Positional Licensing analysis is found. §2.7 summarizes the chapter.

2.2 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 (5) based on descriptions in Noonan (1992). The correspondences are the obvious ones, with *a* alternating with ə.

(5) a.

i		u
e	ə	o

b.

ɪ		ʊ
ɛ		ɔ
	a	

Either value of [±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 (6) 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 shown in (21) below. All

Lango data are from Woock & Noonan (1979), Noonan (1992), and Smolensky (2006), and tones are given only when they are provided by these sources. See also Archangeli & Pulleyblank (1994) for a detailed discussion of the facts.

(6)

	Root	*Gloss*	*1sg poss.*	*3sg poss.*
a.	ŋùt	'neck'	ŋùt-ə́	ŋùt-é
b.	wót	'son'	wód-ə́	wód-é
c.	ém	'thigh'	ém-ə́	ém-é
d.	ɲèt	'side'	ɲèt-ə́	ɲèt-é
e.	ɲím	'forehead'	ɲím-ə́	ɲím-é
f.	cíŋ	'hand'	cíŋ-ə́	cíŋ-é

The forms in (7) show the same 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 (6).

(7)

a.	bwɔ́m	'wing'	bwɔ́m-á	bwɔ́m-ɛ́
b.	wàŋ	'eye'	wàŋ-á	wàŋ-ɛ́
c.	lɛ́b	'tongue'	lɛ́b-á	lɛ́b-ɛ́
d.	tyɛ́n	'leg'	tyɛ́n-á	tyɛ́n-ɛ́
e.	yìc	'stomach'	yì-á	yì-ɛ́[2]
f.	yíb	'tail'	yíb-á	yíb-ɛ́

The Positional Licensing analysis developed below is based largely on the analysis of Smolensky (2006), which itself draws heavily on the analysis of Archangeli

[2]Woock & Noonan (1979), from whom this example is taken, do not comment on the loss of *c*.

& Pulleyblank (1994). For Smolensky, harmony is driven by the AGREE constraint in (4), repeated in (8).

(8) AGREE-[±ATR]: Vowels in adjacent syllables must have the same value for [±ATR].

With no directionality or morpheme dominance specified by AGREE, it falls to other constraints to filter the set of AGREE-satisfying candidates by ruling out certain spreading configurations. Smolensky's filtering constraints are given in (9). Three constraints (with numerical subscripts) block [+ATR] spreading in certain cases, and three others (with alphabetical subscripts) block [–ATR] spreading.

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

$\mathbb{C}_1$:	No [+ATR] spread from [–hi] source in closed σ.	*regulate [+ATR] spread*
$\mathbb{C}_2$:	No regressive [+ATR] spread from a [–hi] source.	
$\mathbb{C}_3$:	No regressive [+ATR] spread from a [–front] V onto a [–hi] V in a closed σ.	
$\mathbb{C}_X$:	No regressive [–ATR] spread.	*regulate [–ATR] spread*
$\mathbb{C}_Y$:	No [–ATR] spread from a [+front] vowel.	
$\mathbb{C}_Z$:	*[–ATR, +hi]	

These filtering constraints, which are adopted in the present analysis, 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, one of the constraints above must rule out the candidate

with [–ATR] spreading, and *vice versa*. Consequently, explaining why one value of [±ATR] spreads consists of explaining why the other value cannot spread.

The first filtering constraint is at work in (6), where the root vowels' [+ATR] features spread to /-a/ or /-ɛ/. Regressive [–ATR] spreading from the suffixes to the roots is ruled out by the constraint in (10). $\mathbb{C}_X$ 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 formally, $\mathbb{C}_X$ blocks right-headed [–ATR] domains.

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

To give more examples of progressive [+ATR] harmony, the data in (11) show harmony within finite verbs. The harmonizing suffix is /-a/ '1st person singular object.' A full gloss is given for (11a) 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 (12) are underlyingly harmonic and verify that the suffix does indeed alternate.

(11) a. dákó ò-rùk-ə́
woman 3sg.subj-dressed-1sg.obj
'The woman dressed me.'

b. dákó ò-rùc-ə́ 'The woman confused me.'

c. dákó ò-pwòd-ə́ 'The woman beat me.'

d. dákó ò-pòn-ə́ 'The woman avoided me.'

e. dákó ò-cèl-ə́ 'The woman hit me.'

f. dákó ò-bi̗t-ə́ 'The woman lured me.'

g. dákó ò-wi̗ŋ-ə́ 'The woman heard me.'

(12)

a.	dákó ò-lʊ̀b-á	‘The woman followed me.’
b.	dákó ò-lwɔ̀k-á	‘The woman washed me.’
c.	dákó ò-kɔ̀ŋ-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-nɛ̀n-á	‘The woman saw me.’
g.	dákó ò-tɛ̀l-á	‘The woman pulled me.’
h.	dákó ò-lìm-á	‘The woman visited me.’
i.	dákó ò-lìk-á	‘The woman struggled with me.’

(13) and (14) show regressive spreading of [+ATR] with spreading from a suffix to a root. The suffixes in (13) are /-Ci/ ‘2nd person singular possessive,’ /-wu/ ‘2nd person plural possessive,’ and /-i/ ‘2nd person singular object.’

(13)

a.	kɔ́m	‘chair’	kòm-mí	‘your (sg) chair’
b.	kɔ́m	‘chair’	kòm-wú	‘your (pl) chair’
c.	bɔ́	‘net’	bó-wú	‘your (pl) net’
d.	cʊ̀ŋ	‘chaff’	cùŋ-wú	‘your (pl) chaff’
e.	jɔ̀	‘people’	jò-wú	‘your (pl) people’
f.	dɛ̀k	‘stew’	dèk-kí	‘your (sg) stew’
g.	lɛ̀	‘net’	lè-wú	‘your (pl) net’
h.	pí	‘for’	pì̀-wú	‘for you’

(14) ò-kòŋ-í ‘she helped you’ (cf. (12c))

Progressive [–ATR] harmony is ruled out by Smolensky for (13) and (14) by

$\mathbb{C}_Z$, defined in (15). Progressive harmony would yield ʊ and ɪ 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.[3]

(15) $\mathbb{C}_Z$: *[–ATR, +hi]

In addition, the final three forms in (13) are subject to $\mathbb{C}_Y$ (16). [–ATR] may not spread from 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 [±front] instead of [±back], but the two features are equivalent such that [αfront] = [$-\alpha$back].[4] Both $\mathbb{C}_Y$ and $\mathbb{C}_Z$ prevent [–ATR] harmony in the last three forms in (13).

(16) $\mathbb{C}_Y$: 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 (17). 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 (19). The forms

[3]Smolensky (2006) gives two definitions of this constraint, one that is exactly like (15), and another that penalizes only unfaithful lax high vowels. He does not seem to favor one over the other, so I adopt the former: $\mathbb{C}_Z$ penalizes any lax high vowel, unfaithful or not.

[4]The mnemonic device employed by Smolensky may be helpful here as well: The '+' values of [±ATR], [±hi], and [±front] are all compatible (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.

in (18) are underlyingly harmonic and show the underlying specification of the suffix vowel.

(17)

	Root	*Gloss*	*Infinitive*
a.	lwɔk	'wash'	lwɔk-kɔ
b.	lʊb	'follow'	lʊb-bɔ
c.	ɲɔn	'step on'	ɲɔn-nɔ
d.	jʊk	'stop'	jʊk-kɔ

(18)

a.	riŋ	'run'	riŋ-ŋo
b.	ket	'put'	ket-to
c.	ruc	'entangle'	ruc-co
d.	pwod	'beat'	pwod-do

(19) $\mathbb{C}_2$: 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, $\mathbb{C}_3$ (20) rules out [+ATR] harmony in (17a) and (17c). 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.

(20) $\mathbb{C}_3$: 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. Ex-

amples of this sort are given in (21). Here, spreading of each value of [±ATR] is ruled out by one of the filtering constraints. For example, in (21i), [+ATR] spreading is blocked by $\mathbb{C}_2$ (the non-high vowel cannot be the source of leftward spreading), and [–ATR] spreading is blocked by $\mathbb{C}_Y$ (the front vowel cannot be the source of [–ATR] spreading). 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.

(21)	a.	twòl-lá	'my snake'	i.	lɪm-mo	'to visit'
	b.	gwók-ká	'my dog'	j.	way-o	'to pull'
	c.	búk-wá	'our book'	k.	cam-mo	'to eat'
	d.	búk-gí	'their book'	l.	nɛn-no	'to see'
	e.	gwèn-ná	'my chicken'	m.	dɛp-po	'to gather'
	f.	rwót-tá	'my chief'	n.	dɛ̀k-wú	'your (pl) stew'
	g.	dòk-ká	'my cattle'	o.	ò-cèl-wá	'she hit us'
	h.	ɲə̀ŋ-ŋá	'my crocodile'	p.	ò-cèl-gí	'she hit them'

The forms in (21a)–(21h) 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 $\mathbb{C}_1$ (22) to account for (21a)–(21h). Again, [+ATR] and [–hi] conflict, so a vowel with these features makes a poor domain head.

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

Compare (21a)–(21h) to (23), where [+ATR] harmony whose source is in a closed syllable is allowed because the source vowel in those forms is high.

(23)

	Root	*Gloss*	*1sg. poss.*
a.	búk	'book'	búk-kə́
b.	òpúk	'cat'	òpúk-kə́
c.	píg	'juice'	píg-gə́

To reiterate a point made above in passing, if the root and suffix vowels are already harmonic, nothing changes, as the examples in (24), plus many of the examples above, show:

(24)

a.	dɛ̀k-ká	'my stew'
b.	ɔ̀t-tá	'my house'
c.	ŋɔ́ŋ-ŋí	'your (sg) crocodile'
d.	rwót-tí	'your (sg) chief'
e.	búk-kí	'your (sg) book'
f.	ɲì̀ŋ-wú	'your (pl) name'

To summarize, Lango has four strategies for dealing with disharmonic root-suffix combinations: progressive [+ATR] spreading (6), regressive [+ATR] spreading (13), progressive [–ATR] spreading (17), and no spreading at all (21).

The question of which feature spreads when and in which direction is an interesting one, but a deeper discussion of the patterns would detract from the issue of noniterativity. The reader is referred to Archangeli & Pulleyblank (1994) and

Smolensky (2006) for insightful discussion. See also Noonan (1992) for a different perspective.

Smolensky's theory of directionality makes liberal use of Local Constraint Conjunction and his theory of domain-headedness. Although those filtering constraints are an important part of the Positional Licensing analysis developed here, they are largely tangential to this chapter's main argument, which is that the extent of spreading in Lango is driven by Positional Licensing. Any constraint(s) that correctly predict(s) the direction of spreading can replace Smolensky's filtering constraints without threatening the Positional Licensing approach's success. Smolensky's constraints are adopted for expedience, and the current analysis is not committed to the theoretical positions of Smolensky (2006). The Positional Licensing and directionality pieces of the analysis stand or fall on their own independent merits. I argued against Local Constraint Conjunction in Chapter 1, and in Chapter 5 I adopt Smolensky's theory of domain headedness. Smolensky (2006) argues for the filtering constraints himself, and evaluation of his arguments must await future research.

Noonan's (1992) view of Lango's harmony is very different from Smolensky's. 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 (17) are treated as exceptions since they all involve what Noonan identifies as the stem-vowel suffix /-o/. In the discussion above (17), I identified that suffix as the infinitival /-Co/, following Smolensky (2006) and Woock & Noonan (1979), rather than the stem-vowel suffix because of the

gemination induced by this suffix on verbs. This gemination suggests that the suffix in those examples is distinct from other instances of Noonan's stem vowel, which doesn't trigger gemination. As I argue below, the stem-vowel suffix (apart from the reanalysis of some cases as an infinitival suffix) may be better identified as part of the root, not a separate morpheme. I have selected Smolensky's analysis as the basis for mine because Smolensky's analysis incorporates the data from (17) into the more general harmony system so that they are not exceptional. However, 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 [–ATR] suffix in (17) only appears when the root contains ɔ or ʊ. This seems to necessitate spreading [–ATR], which is incompatible with privativity (and hence privativity is not adopted here). But it is tempting to skirt the issue by invoking allomorph selection: The suffixes in (17) and (18) are separately listed allomorphs, and the one specified for [+ATR] (more accurately, under privativity, just [ATR]) is the default. The one lacking an ATR feature is selected just when the root contains a back non-low vowel that also lacks an ATR feature. Now we don't need to spread the unspecified feature. However, Noonan (1992:272 fn. 31) notes that some speakers additionally allow the [–ATR] allomorph when the root contains ɛ. Since ɛ, ɔ, ʊ is not a natural class in Lango, the rules governing allomorph selection would have to be more complex for these speakers, and more importantly 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 re-

quire a feature's absence is one of the attractions of privativity in general, but this principle prevents us from formalizing the generalization concerning the [–ATR] allomorph's distribution. 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),' *ryɛ̀ttò* 'to winnow (intransitive),' and *nyìkò* 'to move slightly away' show that this in an incorrect generalization. It seems simpler to abandon privativity and allow [–ATR] to spread.[5]

The pieces of Smolensky's (2006) analysis are now in place. The filtering constraints (henceforth the "ℂ constraints") are recapitulated in (25). $\mathbb{C}_1$, $\mathbb{C}_2$, and $\mathbb{C}_3$ determine when [+ATR] may spread, and $\mathbb{C}_X$, $\mathbb{C}_Y$, and $\mathbb{C}_Z$ determine when [–ATR] may spread. No ranking among these constraints is posited. For perspicuity, the definitions of ℂ constraints that assign violations in subsequent Tableaux are repeated below those Tableaux.

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

$\mathbb{C}_1$:	No [+ATR] spread from [–hi] source in closed σ.	*regulate [+ATR] spread*
$\mathbb{C}_2$:	No regressive [+ATR] spread from a [–hi] source.	
$\mathbb{C}_3$:	No regressive [+ATR] spread from a [–front] V onto a [–hi] V in a closed σ.	
$\mathbb{C}_X$:	No regressive [–ATR] spread.	*regulate [–ATR] spread*
$\mathbb{C}_Y$:	No [–ATR] spread from a [+front] vowel.	
$\mathbb{C}_Z$:	*[–ATR, +hi]	

[5]Taking a wider view, the strong claim—which Noonan does not make—that ATR is a universally privative feature is untenable. If we adopt [–ATR] as the unspecified feature on basis of Lango's harmony, we cannot account for Nez Perce (see Chapter 5), where, according to Hall & Hall (1980), [–ATR] is the active feature and both [+ATR] and [–ATR] spread postlexically.

In (26)–(28), Tableaux show Smolensky's analysis in action, with IDENT[ATR] replacing the equivalent F[ATR] from his Tableaux. In (26), the candidate with [–ATR] harmony—candidate (c)—violates both $\mathbb{C}_Y$ (because the source of the [–ATR] feature is a front vowel) and $\mathbb{C}_Z$ (because harmony yields a [+high, –ATR] vowel) and is therefore eliminated. Candidate (b), with [+ATR] harmony, violates none of the $\mathbb{C}$ constraints and therefore emerges as the winner, candidate (a) having been eliminated by AGREE-[±ATR].

(26) *[+ATR] Spreading*

/lɛ̀-wú/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	AGREE	ID[ATR]
a. lɛ̀-wú							*!	
☞ b. lɛ̀-wú								*
c. lɛ̀-wʊ́					*!	*!		*

$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.
$\mathbb{C}_Z$: *[–ATR, +hi]

Conversely, in (27), candidate (b), with [+ATR] harmony, violates $\mathbb{C}_2$ because the source of the [+ATR] feature is a non-high vowel and the spreading is regressive. Also, $\mathbb{C}_3$ 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 $\mathbb{C}$ constraints and is optimal. As before, the disharmonic candidate (a) is eliminated by AGREE-[±ATR].

(27) *[–ATR] Spreading*

/lwɔk-Co/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Agree	Id[ATR]
a. lwɔk-ko							*!	
b. lwok-ko		*!	*!					*
☞ c. lwɔk-kɔ								*

$\mathbb{C}_2$: No regressive [+ATR] spread from a [–hi] source.
$\mathbb{C}_3$: No regressive [+ATR] spread from a [–front] V onto a [–hi] V in a closed σ.

Finally, (28) shows a form in which the disharmonic candidate is optimal. Here, the [+ATR]-spreading candidate is ruled out by $\mathbb{C}_3$, and the [–ATR]-spreading candidate fatally violates $\mathbb{C}_X$ and $\mathbb{C}_Z$. With both harmonizing candidates eliminated, the disharmonic form wins because it violates only the lower-ranked Agree-[±ATR].

(28) *No Spreading*

dɛ̀k-wú/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Agree	Id[ATR]
☞ a. dɛ̀k-wú							*	
b. dèk-wú			*!					*
c. dɛ̀k-wǒ					*!	*!		*

$\mathbb{C}_3$: No regressive [+ATR] spread from a [–front] V onto a [–hi] V in a closed σ.
$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.
$\mathbb{C}_Z$: *[–ATR, +hi]

A further option is possible: Suppose neither the [+ATR]-spreading candidate nor the [–ATR]-spreading candidate violate the $\mathbb{C}$ constraints. Which one wins? Smolensky is silent on the issue. Such a form would require an input with the schematic shape /…$V_1(C_1)$–$(C_2)V_2$/, where V_1 can be ɔ or a, and V_2 can be

either *i* or *u*. At least one of C_1 and C_2 must be present to avoid hiatus resolution via coalescence (see Noonan 1992), and both consonants can be present only if $V_2 = i$. Without evidence one way or the other, I cannot say which harmonic candidate actually emerges. Perhaps even free variation exists in these cases. Selecting an optimal harmonic candidate is reasonably simple, and several strategies are possible: Dividing IDENT[ATR] into IDENT[+ATR] and IDENT[–ATR] (Hall 2006, McCarthy & Prince 1995, Pater 1999) and ranking one over the other will suffice, as will invoking root faithfulness vs. affix faithfulness. Likewise, low-ranking headedness constraints (in the spirit of Smolensky (2006)) that prefer left- or right-headed ATR domains will select one harmonic candidate over the other. Yet another option is to posit crucial rankings between the $\mathbb{C}$ constraints. Leaving this point unresolved does not affect the analysis below.

Smolensky (2006) is concerned with the direction and possibility of harmony, not the extent of the harmonic domain (which is the primary interest of this chapter). Consequently, the data from (1) are tangential to the goals of that work, but they bear crucially on the question of noniterativity's place in phonology. More examples showing incomplete harmony are given in (29). In all of these examples, the root contains more than one vowel and regressive harmony targets only the root-final vowel.[6] Other root vowels retain their underlying features. The resulting form has a disharmonic root, but as (30) shows, the analysis of Smolensky (2006) predicts complete harmony. (☹ marks the predicted output, and (☞) notes the correct output.)

[6]In fast-speech, a regressive harmonic domain can include the final *two* root vowels as long as the first of those two vowels is stressed. Consequently, some—but not all—of the forms marked ungrammatical in (29) are grammatical in fast speech. I set this complication aside for now but return to it in §2.5.

(29)

a.	bɔ̀ŋɔ́	‘dress’	bɔ̀ŋɔ́-nḯ	‘your (sg) dress’	(*bɔ̀ŋɔ́-nḯ)
b.	cɔ̀ŋɔ̀	‘beer’	cɔ̀ŋɔ̀-nḯ	‘your (sg) beer’	(*cɔ̀ŋɔ̀-nḯ)
c.	àmʊ́k	‘shoe’	àmúk-kḯ	‘your (sg) shoe’	(*àmúk-kḯ)
d.	àtîn	‘child’	àtḯn-nî	‘your (sg) child’	(*ətḯn-nî)
e.	ìmáɲ	‘liver’	ìmáɲ-ḯ	‘your (sg) liver’	(*ìmáɲ-ḯ)
f.	pàlà	‘knife’	pàlə-wú	‘your (pl) knife’	(*pələ-wú)
g.	òkwɛ́ᵎcɛ́	‘bitch’	òkwɛ́ᵎcé-nḯ	‘your (sg) bitch’	(*òkwéᵎcé-nḯ)
h.	òkwɛ́ᵎcɛ́	‘bitch’	òkwɛ́ᵎcé-wú	‘your (pl) bitch’	(*òkwéᵎcé-wú)
i.	lɛ̀mʼʊn	‘orange’	lɛ̀mʼun-wú	‘your (pl) orange’	(*lèmʼun-wú*)
j.	mɔ̀tɔ̀kà	‘car’	mɔ̀tɔ̀kə-ê	‘cars’	(*mòtòkə-ê)
k.	dàktàl	‘doctor’	dàktəl-ê	‘doctors’	(*dəktəl-ê)
l.	ìdíkɛ̀	‘leech’	ìdîk-ê	‘leeches’	(*ìdîk-ê)

(30)

/bɔ̀ŋɔ́-nḯ/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Agr	Id[ATR]
a. bɔ̀ŋɔ́nḯ							*!	
(☞) b. bɔ̀ŋɔ́nḯ							*!	*
☹ c. bɔ̀ŋɔ́nḯ								**
d. bɔ̀ŋɔ́ní						*!		*

$\mathbb{C}_Z$: *[–ATR, +hi]

Noonan (1992) identifies some of the root-final vowels in (29)—notably the ɔ in the first two examples—as a suffix he calls the “stem vowel” and which joins with the root to create the noun or verb stem. This suffix is typically *o* or ɔ, matching the ATR feature of the other root vowel(s), but any other vowel may also be a stem vowel. Noonan identifies certain behavioral characteristics

of this suffix but notes that it "has no discernable meaning" (Noonan 1992:70). It harmonizes with the root vowel (*bɔ̀ŋ-ɔ́* 'dress' vs. *dák-ô* 'woman') and, as (29) shows, is the target of harmony from other suffixes. However, since the stem vowel has no semantic content and can be any member of the language's vowel inventory, it seems likely that the stem vowel is the vestige of a historically active suffix (a historical noun-class system, perhaps) but is now a part of the noun or verb root.[7] I make the simplifying assumption that this is the case, although adopting Noonan's position is equally compatible with the Positional Licensing analysis. Departing from Noonan on this point affects the analysis in one minor way, which I point out below.

Other evidence suggests that stem vowels are part of the root. Noonan (1992:90) notes that all transitive verbs have a stem vowel, but intransitive verbs "are about equally divided as to whether they have a stem vowel." He gives no generalization about which intransitive verbs have or lack stem vowels, and it seems much simpler, especially from an acquisition perspective, to assume that these vowels are part of the root, as opposed to positing idiosyncratic lexical markings that identify a root as requiring a stem vowel or not. As for the transitive verbs, I follow Smolensky (2006) in assuming that these "stem vowels" are actually a separate infinitival suffix /-Co/ because, as seen in (17) above, this suffix (unlike

[7]It is not clear to me that the behavioral characteristics that Noonan attributes to stem vowels are unique to that suffix. Rather, Noonan shows that these stem vowels participate in language-wide patterns of deletion and coalescence, e.g. The failure of Noonan's root vowels to undergo these processes may be due to their being stressed (stress is generally root-initial). Stem vowels undergo the processes not because they're outside the root, but because they're unstressed. The question of whether stem vowels behave differently from root vowels obviously deserves more attention than it can be granted here, but I wish only to note that stem vowels seem to show no behavior that is unattested elsewhere in Lango, and thus cannot be identified as a *bona fide* morpheme on phonotactic grounds.

the stem vowel generally) induces gemination.[8]

The incomplete harmony in (29) cannot be attributed to opaque or transparent segments. In several examples (e.g. (29a)), the vowel that doesn't harmonize is identical to the root vowel that does harmonize. Thus it cannot be the case that certain vowels don't participate in harmony.

These data are reminiscent of, e.g., German umlaut[9] or Tudanca Spanish metaphony[10] (see Chapter 1 for more on both) in that a feature spreads from a suffix vowel to the last root vowel. In derivational terms, we can account for (29) with the rule in (31).

(31) $V\ C_0\,]_{\text{Root}}\ \ C_0\ V$

[+ATR]

But in OT, Agree-style constraints are inadequate for this sort of spreading, as others have noted (McCarthy 2003, 2004). Agree penalizes any candidate with a [+ATR] vowel and a [–ATR] vowel: In the absence of complete harmony there is always at least one pair of adjacent syllables containing disharmonic vowels, and this juncture triggers a fatal violation of Agree-[±ATR]. Agree cannot be satisfied by anything less than complete harmony, a property has been labeled "sour grapes" by Padgett (1995; see also McCarthy 2003, 2004).

Alignment has a similar problem: With nothing to block harmony extending all the way to the left edge of the word (see §2.4 below for arguments against

[8] I have no explanation for why the infinitival suffix only appears with transitive verbs. Perhaps it is better identified as a transitivizing suffix.

[9] *giozan* 'to pour' vs. *giuzu* 'pour (1st person singular present)' (McCormick 1981, van Coetsem & McCormick 1982)

[10] /sekal-U/ → *sekA1U* 'to dry him': capitalization indicates [–ATR] (Flemming 1994, Walker 2004)

such blockers), Alignment cannot be satisfied with spreading to just the root-final syllable. To be more specific, if, say, ALIGN([±ATR],L;Word,L) motivates harmony (by requiring all ATR domains to be left-aligned within a word, counted by syllables for expository purposes), then spreading the 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. To correctly produce both *ɔ̀púk-kə́* 'my cat' (from (23b)) and *bɔ̀ŋó-nɪ́* 'your dress' (1a), 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. 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 a single rule can account for both Lango and Kinande with just a change in one parameter. But any constraint that produces full harmony in Kinande cannot be satisfied with minimal harmony in Lango. 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 abandon the assumptions that Lango exhibits genuine vowel harmony (perhaps the assimilation is more closely related to metaphony and umlaut, to which parallels were drawn above) and that this assimilation is fundamentally noniterative. A closer look at Lango reveals that both assumptions are in fact wrong. 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, and it is therefore 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.

2.3 Licensing as an Alternative to Iterativity

2.3.1 The Licensing Analysis

There are several reasons to think that Positional Licensing (Crosswhite 2000, Itô & Mester 1994, Zoll 1997, 1998b), and not a traditional harmony-driving mechanism, is responsible for ATR harmony in Lango. We've already seen that root-affix assimilation creates disharmonic stems (see (29)). 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 genuine vowel harmony, we'd expect all root vowels to change under suffixation in (29). 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.

Furthermore, from a harmonic point of view, the outputs in (29) are often no better than their inputs. For example, *bɔ̀ŋó-ní* 'your dress' has a disyllabic domain of harmony plus one vowel that does not harmonize. Its input, /bɔ̀ŋɔ́-nɪ́/, has exactly the same configuration. All that changes is the order of the harmonic and disharmonic domains. Certain standard harmony constraints can prefer the output to the input in this case (e.g., Alignment might favor *bɔ̀ŋó-ní* 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 advanced, and from the point of view of root harmony, the correct surface form is actually worse than the input.

In addition, while most roots are harmonic, a number aren't:

(32)	a.	cúpá	'bottle'	f.	kàkwènè	'where'
	b.	òmín	'brother'	g.	láŋô	'Lango'
	c.	àbòlò	'plantain'	h.	nɪ́âŋ	'sugarcane'
	d.	bìló	'charcoal'	i.	òbíâ	'money'
	e.	gwɛ̀nò	'chicken'	j.	òlwɪ̀t	'eagle'

To the best of my knowledge, these examples are all monomorphemic,[11] 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,

[11] The caveat concerning stem vowels should be kept in mind, but since stem vowels harmonize with the root, the disharmony displayed by many final vowels in (32) suggests that they're not stem vowels.

is not synchronically active in the language. Even languages that uncontroversially have full-fledged harmony systems often contain disharmonic exceptions, but taken with the other evidence against a harmony system in Lango, these roots suggest that this language does not have vowel harmony *per se*.

Consequently, we don't have to shoehorn the one-syllable spreading into a harmony system. Rather, the disharmonic forms in (32) indicate that some other mechanism is responsible for Lango's "harmony."[12] Furthermore, harmony-inducing constraints such as ALIGN and AGREE have been shown to be particularly troublesome in terms of the too-many-solutions problem (Blumenfeld 2006). For example, AGREE suffers from the sour-grapes problem whereby no harmony occurs at all if complete harmony is impossible (McCarthy 2003, 2004, Padgett 1995). ALIGN can, in principle, trigger bizarre and unattested repairs such as deletion of all non-harmonic vowels (McCarthy 2004). More satisfactory solutions are needed for harmony in general, and this fact frees us to seek alternative analyses of Lango's harmony in particular.

If Lango does not exhibit "harmony" as the term is traditionally understood, what is the motivation for the one-syllable spreading seen in (29)? 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

[12] I will continue to use the term "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.

this is the goal. Roots are "prominent positions which license more contrasts than other non-prominent positions" (Urbanczyk 2006:194; see also Beckman 1999, Steriade 1995b and Chapter 3 below). Consequently, the suffix vowel's ATR feature is more prominent (i.e. more likely to be correctly perceived) if it is also carried by a root vowel. This is exactly the intuition captured by Positional Licensing: The feature [±ATR] is *licensed* on roots (cf. Generalized Licensing (Walker 2004) and Indirect Licensing (Steriade 1995b)):

(33) LICENSE-[ATR]: [±ATR] features must be linked to root segments.[13]

This constraint says, essentially, that a contrast based on [±ATR] is only permitted in roots, and the justification is that roots are more prominent than affixes. (See Chapter 3 for a discussion of root prominence.) 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 ATR hosts. This means MAX or possibly REALIZE-MORPH (Kurisu 2001) must be highly ranked in Lango.)

It is important to note that this Positional Licensing constraint is very differ-

[13]It is equally possible to formalize this constraint in the vein of COINCIDE (Itô & Mester 1999, Zoll 1998a). The result would be a constraint requiring the scope of [±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.

ent from the ones adopted by Crosswhite (2001). Whereas the constraints used here merely require the relevant feature to be linked to a licenser, Crosswhite's constraints (such as the one in (34)) require the relevant feature to be *wholly contained* within the licensing category.

(34) LICENSE-Nonperipheral/Stress: Nonperipheral vowels are licensed only in stressed positions. (Crosswhite 2001:24)

LICENSE-Nonperipheral/Stress effectively bans nonperipheral vowels from unstressed positions altogether, whether or not these nonperipheral features are shared by stressed vowels. Crosswhite's brand of Licensing constraints are inappropriate for Lango because while Lango imposes special requirements on affixal [ATR] features, it doesn't ban them. This means her approach to Licensing cannot be used here.

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

(35)

/bɔ̀ŋɔ́-nɪ́/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	LIC-[ATR]	IDENT
a. bɔ̀ŋɔ́-nɪ́							*!	
☞ b. bɔ̀ŋó-nɪ́								*
c. bɔ̀ŋó-nɪ́								**!
d. bɔ̀ŋɔ́-nɪ́						*!		*

$\mathbb{C}_Z$: *[–ATR, +hi]

The extent of spreading doesn't matter to LICENSE-[ATR] as long as the suffix vowel and some root vowel share an ATR feature. Only the fully faithful candi-

date (a) violates LICENSE-[ATR]. Crucially, candidate (b) no longer violates the harmony-driving constraint (cf. (30) above). $\mathbb{C}_Z$ 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 now 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[ATR] selects the candidate that does minimal violence to the input. The form in which the suffix's [+ATR] feature spreads only to the root-final vowel wins: One violation of IDENT[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 because noniterativity falls out from other considerations. That is, Lango's harmony exhibits emergent noniterativity.

Recall that Noonan (1992) identifies some of the root-final vowels in (29) as suffixes. If Noonan is right in his analysis of this morpheme, it means only that LICENSE-[ATR] should be amended to require licensing by the *stem* rather than the *root*: Suffixes other than the stem vowel must share their ATR features with the noun or verb stem. Alternatively, the stem vowel may be one of Selkirk's (1982) root-affixes which, when attached to a root, yields a larger root rather than a stem. To ensure that the stem vowel itself harmonizes with the root, we can either use LICENSE-[ATR] (the stem vowel must share its ATR feature with the stem it attaches to—i.e. the root proper), or we can invoke some kind of

low-ranking stem-level harmony constraint. (As support for the latter approach, recall that most roots are fully harmonic.)

Further evidence that root-licensing is the goal of spreading comes from (36).

(36)

a.	tòj-érê	'beat up'
b.	wùc-érê	'throw'
c.	nèk-érê	'kill'
d.	rwèŋ-érê	'lose'
e.	cèg-érê	'close'
f.	kɔ̀b-ɛ̀rɛ̂	'transfer'
g.	mɛ̀-ɛ̀rɛ̂	'intoxicate'[14]
h.	à-câŋ-ɛ̀rɛ̂	'I healed myself'
i.	cul-lere	'penis (3sg alien)'
j.	kùl-lérê	'wart hog (3sg alien)'
k.	gwôk-kérê	'dog (3sg alien)'

Two suffixes are illustrated here: the middle voice suffix /-ɛ́rɛ̂/ in (36a)–(36h), and the third-person singular possessive alienable suffix /-mɛ́rɛ̂/. Both suffix vowels harmonize.[15] 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 mirror image would require) outputs such as **tòj-érê*. Only the first suffix vowel changes because

[14]This form comes from /mɛr-ɛ̀rɛ̂/ (Noonan 1992:101), but Noonan is silent on the loss of *r*.

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

[+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)

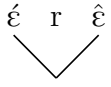
/tòj-érɛ̂/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Lic-[ATR]	Id[ATR]
a. tòj-érɛ̂							*!*	
b. tòj-érê							*!	*
☞ c. tòj-érê								**
d. tɔ̀j-érɛ̂				*!	*!			*

$\mathbb{C}_X$: No regressive [–ATR] spread.
$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.

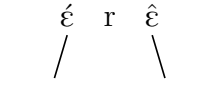
Licensing is not satisfied unless both suffix vowels harmonize. If just one vowel harmonizes, the other's ATR feature will not be adequately licensed. In the candidate with noniterative spreading, **tòj-érɛ̂*, the final vowel's [–ATR] feature is not linked to the root.

The noniterative rule-based analysis can be salvaged by assuming the vowels in /-érɛ̂/ 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.

(38)



(39)



With just one [–ATR] feature for the two vowels, noniterative spreading can target this feature and simultaneously change both vowels. Without evidence one way or the other for this representational assumption, the superior analysis is the

one that requires no assumption. This is the Licensing analysis, which must cope with both (38) and (39) under Richness of the Base. Unless all [–ATR] features are replaced by [+ATR], some [–ATR] feature will remain unlicensed. Licensing has the power to change one feature as in (38) or two features as in (39).

Another related point casts doubt on the rule-based analysis. Recall that two suffixes are shown in (36). The rule-based analysis must claim that both /-ɛ́rɛ̂/ and /-mɛ́rɛ̂/ have the configuration in (38). But why should this be? No part of the rule-based analysis leads us to expect the underlying representations of these suffixes to have the same feature structure. They could just as easily have different structures: One could look like (38) underlyingly, and the other could look like (39). In the rule-based analysis, it is a coincidence that the suffixes harmonize in exactly the same way. But the Licensing analysis generates the same output for both suffixes regardless of their underlying configurations and thereby explains their identical behavior.

The Tableaux in (35) and (37) demonstrate that LICENSE-[ATR] can trigger both one-syllable spreading in one case and two-syllable spreading in another case. The reason is that these are the minimal spreading domains necessary to satisfy LICENSE-[ATR] in the two forms. LICENSE-[ATR] is successful and an analysis based on noniterativity fails because the former is output-oriented and the latter is process-oriented. The contrast between *bɔ̀ŋɔ́-nɪ́* and *tɔ̀j-ɛ́rɛ̂* shows that despite the appearance of noniterative spreading, it is the resulting configuration that matters, not the extent of spreading. At the outset, rule-based phonology seemed superior to OT in the face of Lango's harmony because rules can capture the iterative/noniterative dichotomy more readily than OT-style constraints, but

the contrast between *bɔ̀ŋɔ́-nɪ́* and *tɔ̀j-érê* reveals an advantage in the opposite direction. The Licensing analysis straightforwardly predicts both forms, while a noniterative rule cannot produce both forms. (Of course, an iterative rule may better account for *tɔ̀j-érê*, but it cannot produce *bɔ̀ŋɔ́-nɪ́*.) The success of the Licensing analysis lies in the fact that it specifies a desirable output configuration and accepts any process, iterative or not, that generates this configuration. The rule-based analysis necessarily ties harmony to a single process.

The data in (36) also show that Lango's harmony cannot be foot-bound. There is no evidence for ternary feet in Lango, but these forms have a three-syllable harmonic domain. An analysis that invokes standard (i.e. "iterative") harmony drivers and requires harmony just within a foot cannot account for these forms. Also, stress is generally root-initial (see especially Noonan 1992 but also Tucker & Bryan 1966), so the location of assimilation does not coincide with the only foot that is motivated by the data. But even if we take assimilation to indicate a word-final foot, the forms in (36) are underlyingly harmonic within this foot, and assimilation is unmotivated. Thus Lango's spreading does not belong in the set of foot-bound phenomena discussed in Flemming (1994) and in Chapter 1.

Most importantly, (36) shows that Lango's harmony is not truly noniterative. These data reinforce the conclusion that the assimilatory noniterativity that we began this chapter with is emergent. Just as, e.g., Nasal Place Assimilation stops after one iteration (see Chapter 1) because there is only one preconsonantal nasal in a typical example, ATR spreading in Lango usually stops after one iteration because the relevant constraint is often satisfied at this point. But the constraint does not require noniterativity, so in the right context iterative spread-

ing is produced. Rather than stemming from a noniterativity requirement, the noniterativity seen in Lango is a configurational byproduct.

The remaining Tableaux in this section are included to illustrate the range of harmony 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.' $\mathbb{C}_Z$ blocks progressive harmony in this case.

(40)

/jɔ̀-wú/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Lic-[ATR]	Id[ATR]
a. jɔ̀-wú							*!	
☞ b. jò-wú								*
c. jɔ̀-wʊ́						*!		*

$\mathbb{C}_Z$: *[–ATR, +hi]

Progressive [+ATR] harmony is shown in (41) with *píg-gə́* 'juice (1sg alien).' As usual, $\mathbb{C}_X$ blocks regressive [–ATR] spreading, and in this case the [–ATR] configuration is ruled out by $\mathbb{C}_Z$ as well because of the [+hi, –ATR] vowel.

(41)

/píg-Cá	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Lic-[ATR]	Id[ATR]
a. píg-gá							*!	
☞ b. píg-gə́								*
c. píg-gá				*!		*!		*

$\mathbb{C}_X$: No regressive [–ATR] spread.
$\mathbb{C}_Z$: *[–ATR, +hi]

(42) also shows progressive harmony but this time the spreading feature is [–ATR]. The form is *lwɔkkɔ* 'to wash.' Regressive harmony is illicit in this case

because the source of spreading is a [–hi] vowel.

(42)

/lwɔk-Co/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Lic-[ATR]	Id[ATR]
a. lwɔk-ko							*!	
b. lwok-ko		*!	*!					*
☞ c. lwɔk-kɔ								*

$\mathbb{C}_2$: No regressive [+ATR] spread from a [–hi] source.
$\mathbb{C}_3$: No regressive [+ATR] spread from a [–front] V onto a [–hi] V in a closed σ.

In the next Tableau, root-suffix harmony actually improves the harmony of the underlyingly disharmonic root, *cúpá* 'bottle.' Spreading from the suffix to the root in *cúpə́ní* 'your bottle' creates a fully harmonic word. Compare this Tableau with (35) above, where a harmonic root becomes disharmonic through suffixation. But *cúpə́ní* is not optimal because it is fully harmonic. Rather, it wins because regressive spreading violates none of the $\mathbb{C}$ constraints. Progressive [–ATR] spreading is ruled out by $\mathbb{C}_Z$ because the target vowel is [+hi]. The other fully harmonic possibility, candidate (d), incurs two violations of $\mathbb{C}_Z$ and also violates $\mathbb{C}_X$. Under the Licensing analysis, the complete harmony in the optimal form is coincidental, and rightly so because, as we've already seen, an analysis that enforces complete harmony fails to produce the cases of one-syllable spreading.

(43)

/cúpá-ní/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Lic-[ATR]	Id[ATR]
a. cúpá-ní							*!	
☞ b. cúpə́-ní								*
c. cúpá-ní						*!		*
d. cʊ́pá-ní				*!		*!*		**

$\mathbb{C}_X$: No regressive [–ATR] spread.
$\mathbb{C}_Z$: *[–ATR, +hi]

Finally, (44) illustrates a form with no harmony. The disharmonic *gwènná* 'chicken (1sg alien)' emerges faithfully because the harmonic alternatives both run afoul of the $\mathbb{C}$ constraints. The [+ATR] harmonic form violates $\mathbb{C}_1$ because the source of spreading is a [–hi] vowel in a closed syllable. [–ATR] harmony isn't allowed either because regressive [–ATR] spreading is ruled out by $\mathbb{C}_X$. Since the disharmonic candidate only violates License-[ATR], it is optimal in this case.

(44)

/gwèn-Cá/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Lic-[ATR]	Id[ATR]
☞ a. gwèn-ná							*	
b. gwèn-nə́	*!							*
c. gwɛ̀n-ná				*!				*

$\mathbb{C}_1$: No [+ATR] spread from [–hi] source in closed σ.
$\mathbb{C}_X$: No regressive [–ATR] spread.

A Positional Licensing analysis of vowel harmony has the flexibility to account for the full range of harmonic and disharmonic configurations found in Lango. Taking the vowel alternations to be indicative of a full-blown harmony system leads to trouble because there are many cases in which the attested form is not fully harmonic. On the other hand, if we view harmony in Lango as driven

by prominence and licensing considerations, these otherwise unexpected forms are easy to account for. Harmony does not always target every vowel in a word because the spreading required to achieve complete harmony is overkill. One obvious way to account for incomplete harmony is through a noniterative spreading rule, but as we saw, that approach fails to account for more complex forms. These complex forms share the property of attraction-to-prominence with the one-syllable-spreading forms, and Positional Licensing provides a unified account of both kinds of words without mentioning (non)iterativity. Minimal spreading between the root-final vowel and the suffix vowel(s) is sufficient to satisfy the pressures of Positional Licensing.

Mahanta (to appear) raises objections to the Positional Licensing analysis developed above. Her first objection is that it cannot distinguish the hypothetical mapping /bɔnɔnɔ-ni/ → *bonononi* from the equally hypothetical /bonɔ-nɔni/ → *bonononi*. But as (35) above shows, IDENT prevents spreading beyond the root-final vowel in the former mapping, so that possibility is ruled out by the Licensing analysis. In personal communication, Mahanta clarifies her concern about the second mapping: The output is ambiguous between the structures in (45a) and (45b), but the Licensing analysis is satisfied only by (45a).[16] How do we know that this is indeed the correct output?

(45) a. bo no no ni
[+ATR]

b. bo no no ni
[+ATR] [+ATR]

[16]Actually, the Licensing analysis doesn't predict spreading from the first root vowel to second, as shown in (45b), but I will assume that this spreading is motivated on independent grounds for purposes of the present discussion.

The correct output of Mahanta's hypothetical input is difficult to determine because there seem to be no underlyingly disharmonic suffixes like /-nɔni/ in the language. Nonetheless, the Licensing analysis does indeeed prefer (45a) over (45b) because the latter contains an unlicensed [+ATR] feature. (There is yet another possibility, *bonɔnɔnɪ*, with spreading from the last root vowel. This incurs just one violation of IDENT, so there is reason to suspect it might be the preferred output in the Licensing analysis.)

Notice that Mahanta's objection is not that the Licensing analysis produces the wrong pronunciation, but rather that it might produce the right pronunciation with the wrong abstract featural configuration. This criticism is only valid if (45b) is shown to be the correct output. There is, to my knowledge, no diagnostic in Lango that we can call on to determine which is the correct configuration, and therefore it is of no consequence that the Licensing analysis permits one and not the other. Moreover, there is an independent reason to prefer (45a): This form satisfies the OCP, so unless we adopt a version of Correspondence Theory that includes MAX-feature constraints, there is no reason to retain both [+ATR] features and a good reason to fuse them.

Mahanta also expresses concern about the Licensing analysis's reliance on autosegmental phonology: Suffix vowels will always violate LICENSE-[ATR] unless their features can behave independently of the segments link to multiple vowels. There are two responses to this objection. First, autosegmentalism seems sufficiently well-substantiated that analyses couched within that framework are on reasonably solid ground. Second, only minimal changes would be necessary to import the Licensing analysis into another framework. For example, within

Headed Spans (McCarthy 2004) or Optimal Domains Theory (Cole & Kisseberth 1994), LICENSE-[ATR] might require *spans* or *domains* rather than *features* to overlap with the root. (But see §2.4.2 below for arguments against analyses that use tools specific to these two theories.) In an SPE-style framework in which segments consist of non-overlapping feature matrices, LICENSE-[ATR] could require each ATR feature to have a correspondent in a root segment (Walker 2004). This would trigger an INTEGRITY violation whereby the underlying [+ATR] feature of the suffix has two output correspondents, one in the suffix and the other in the root.

One final note: Recall that Noonan (1992) describes Lango's harmony in terms of [+ATR] dominance. For him, [–ATR] is inert.[17] Under this view, only [+ATR] spreads, and harmony is blocked by CV suffixes unless the source of harmony is [+high]. This analysis is not incompatible with Positional Licensing. [+ATR] still spreads just once in *bɔ̀ŋó-nɪ́* and twice 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 LICENSE-[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]

[17]Despite the objections raised above, it is tempting to say ATR is a privative feature and [–ATR] is nonexistent, even though this renders us wholly incapable of producing the cases where [–ATR] spreads. If this is the case, progressive spreading seems puzzling for the Licensing account: Why should [+ATR] spread to a lax suffix vowel if the suffix vowel has no ATR feature to begin with and therefore doesn't violate Licensing? But this is easy enough to fix if the analysis is modified to require suffix vowels to have licensed ATR features. Segments, not just their features, must meet licensing conditions (see Itô & Mester 1993 for more on this line of reasoning). This would more directly capture the implication of Licensing that an ATR contrast is only permitted in roots.

spreads remain unexplained under this analysis, and therefore Smolensky's approach seems superior.

2.3.2 Benefactive Verbs

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

(46)	a.	/ò-wìllò-ì-á/	→ ò-wìll-á	'he bought it for me'
	b.	/ò-wìllò-ì-í/	→ ò-wi̗ll-í	'he bought it for you (sg)'
	c.	/ò-wìllò-ì-ɛ́/	→ ò-wìll-ɛ́	'he bought it for him/her'
	d.	/ò-wìllò-ì-wá/	→ ò-wìll-ì-wá	'he bought it for us'
	e.	/ò-wìllò-ì-wùnú/	→ ò-wìll-i̗-wùnú	'he bought it for you (pl)'
	f.	/ò-wìllò-ì-wú/	→ ò-wìll-i̗-wú	'he bought it for you (pl)'
	g.	/ò-wi̗llò-ì-ú/	→ ò-wi̗ll-ú	'he bought it for you (pl)'
	h.	/ò-wìllò-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* with vowel-initial suffixes), /-ì/ 'benefactive,' /-á/ 'me,' /-í/ 'you (sg),' /-ɛ́/ 'him/her,' /wá/ 'us,' /wùnú/, /wú/, /ú/ 'you (pl),' /gí/ 'them.'

A suffixal *i* spreads [+ATR] to the root only in (46b) and (46g). In all other forms, the root vowel remains lax. In (46e) and (46f), [+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 (46b) and (46g) on one hand, and (46e) and (46f) on the other. The procedure is this: locate the leftmost tense suffix

vowel and spread [+ATR] left once. Spreading targets the root in (46b) and (46g) because the source is immediately adjacent to the root. Spreading falls short of the root in (46e) and (46f) because the source of spreading is farther 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.

Fortunately, these forms are immediately accounted for by the Licensing analysis once a morphological idiosyncrasy is recognized. Each word in (46) 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-ɛ́/ becomes *téd'd-é* 'to cook for him/her,' for example. Deletion of the benefactive morpheme is apparent in (46a), (46c), and (46g). It also happens in (46b), 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 this suffix never acquires a harmonizing feature from a root: we find *ò-bínn-ì* 'she came at,' not **ò-bínn-ì̀*. One way to account for this is with an Alignment constraint (such as the one in (47)) requiring the left edge of the benefactive suffix to align with the left edge of an ATR domain. This constraint rules out configurations like (48a), with an ATR feature straddling the left boundary of the benefactive suffix, in favor of (48b).

(47) ALIGN(Benefactive, L; ATR, L): The left edge of the benefactive morpheme must align with the left edge of some ATR domain.

(48) a. *ò-bínn-ì

[+ATR]

b. *ò-bínn-ì

[+ATR] [–ATR]

(49)

/ò-bínô-ì/	ALIGN	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	LIC-[ATR]	ID
☞ a. ò-bínn-ì							*	*	
b. ò-bínn-ì	*!								*
c. ò-bínn-ì	*!				*	*	**		*

$\mathbb{C}_X$: No regressive [–ATR] spread.
$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.
$\mathbb{C}_Z$: *[–ATR, +hi]

The forms in (46e) and (46f) show that the benefactive suffix additionally never permits spreading to the root.[18] When it acquires [+ATR] from a following suffix (the Alignment constraint only makes demands of the suffix's left edge, so it can still harmonize with following vowels), 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 (46e) and (46f), although spreading from the object suffix to the benefactive suffix reduces the number of unlicensed features:

[18]Presumably, Noonan didn't note this himself because, e.g., **ò-nɛ̀kk-ì* has regressive [–ATR] spreading which is ruled out independently.

(50)

/ò-wìll-ì-wú/	ALIGN	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	LIC	ID
a. ò-wìll-ì-wú							**!	**	
☞ b. ò-wìll-i̗-wú							*	*	*
c. ò-wi̗ll-i̗-wú	*!								**
d. ò-wìll-ì-wʊ́						*!	**!*		*

$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.
$\mathbb{C}_Z$: *[–ATR, +hi]

The winning candidate has just one violation of Licensing because LICENSE-ATR requires features, not segments, to be licensed. There is just one unlicensed feature in this form that is shared between two vowels.

On the other hand, when the benefactive morpheme is deleted, this barrier is removed, and spreading can reach the root as normal, as in (46b) and (46g).

Let's consider each configuration in (46) individually. In /ò-wìllò-ì-á/ (46a), the object suffix begins with a vowel, so the benefactive morpheme deletes. We're left with *ò-wìll-á*, which is already harmonic. The two [–ATR] features can coalesce, and Licensing is satisfied. The same thing happens in (46c).

In /ò-wìll-ì-í/ (46b), the benefactive morpheme again deletes. [+ATR] can spread from the object suffix to the root to create *ò-wi̗ll-í*. The same thing occurs in (46g).

In /ò-wìllò-ì-wá/ (46d), the benefactive morpheme doesn't delete because the object suffix begins with a consonant. This means that spreading to or from the root as in (51a) is ruled out by the benefactive-specific Alignment constraint, but harmony between the suffixes (in the form of coalescence of their [–ATR] features)

can occur to minimize Licensing violations as in (50), yielding (51b).[19] The same thing happens in (46h). The difference between these cases and (50) is that the surviving root vowel's ATR feature is the same as the harmonizing suffix feature.

(51) a. *ò-wɪll-ɪ-wa
[–ATR]

b. ò- wɪll-ɪ-wa
[–ATR] [–ATR]

In /ò-wìllò-ì-wùnú/ (46e), [+ATR] can spread from the object suffix to the benefactive suffix, but spreading to the root is disallowed by the benefactive's Alignment constraint. The evaluation of this form is virtually identical to (50). As with (50), spreading from one suffix to another leaves just one unlicensed feature. Licensing can't be satisfied, but it can be minimally violated.

The Alignment constraint that produces the benefactive morpheme's special behavior is another blocking condition on par with Smolensky's ℂ constraints. Taking the benefactive *ì*'s idiosyncrasy into account, what looks 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 blocks spreading to the root.

2.4 Alternatives

The analysis above characterizes all the instances of less-than-complete harmony in Lango as spreading to the root. But there are other ways one might characterize

[19] If the OCP is ranked high enough, it can compel violations of the benefactive-specific Alignment constraint, favoring (51a) over (51b). Since the two forms are homophonous, I will simplify the analysis by assuming that the OCP is not ranked high enough to be relevant and that the Alignment constraint is always satisfied.

this harmony, and analyses that build on these alternatives are conceivable. This section addresses such competing accounts. All are shown to be inadequate.

2.4.1 Positional Faithfulness with Agree

Much of the data in (29) is ambiguous between spreading by one syllable and spreading to all but the root-initial vowel. In the latter characterization, we might say that harmony is complete except that the first vowel doesn't participate. The theory of Positional Faithfulness (Beckman 1999) is designed to capture exactly this sort of preferential preservation of segments/features in privileged positions, and we might add the constraint in (52) to the AGREE-based analysis of Smolensky (2006).

(52) IDENT[ATR]-[σ: Corresponding segments in root-initial syllables have identical values for [±ATR].

With IDENT[ATR]-[σ outranking AGREE, no harmonic form that changes the ATR feature of the root-initial syllable can be optimal. The prediction is that harmony will target all vowels in a word except for the root-initial vowel. We must examine roots longer than two syllables to evaluate the accuracy of this claim. (53) shows that harmony in longer roots does not in fact target all non-initial vowels. Rather, harmony spreads just to the root-final vowel as the Licensing analysis predicts:[20]

[20]The harmony domain can be longer in fast speech (see §2.5), but the Positional Faithfulness analysis predicts longer harmony at all speech rates.

(53)

a.	mɔ̀tɔ̀kà	‘doctor’
	mɔ̀tɔ̀kɔ̀-ê	‘doctors’
b.	ɔ̀kwɛ́ᵎcɛ́	‘bitch’
	ɔ̀kwɛ́ᵎcɛ́-nḯ	‘bitches’

However, Positional Faithfulness does get closer to accounting for some of the forms in (29) than the original Agree analysis did. As (54) shows, Ident[ATR]-[σ eliminates the otherwise problematic fully harmonic form in the evaluation of *bɔ̀ŋɔ́-nḯ* (candidate (d)), but now the fully faithful form ties with the intended winner. This highlights the well-known sour-grapes problem with Agree constraints (McCarthy 2003, 2004, Padgett 1995): Agree sees all cases of incomplete or nonexistent harmony as equally bad because it notices only the boundary between the string of [αF] segments and the string of [–αF] segments regardless of where this boundary occurs. It then falls to lower constraints to select the output, and since the lower constraints typically include Faithfulness constraints, the result is that if Agree can't be completely satisfied, no spreading happens at all. Adding the relevant Faithfulness constraints to (54) would be counterproductive: Of the two winners in (54), the correct form is less faithful than the other.

(54)

/bɔ̀ŋɔ́-nḯ/	Id[ATR]-[σ	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	Agree
☞ a. bɔ̀ŋɔ́-nḯ								*
b. bɔ̀ŋɔ́-ní							*!	
☞ c. bɔ̀ŋó-nḯ								*
d. bɔ̀ŋó-nḯ	*!							

$\mathbb{C}_Z$: *[–ATR, +hi]

Assuming this problem can be resolved, either by adding a lower markedness constraint that favors candidate (c) or by replacing AGREE with something more satisfactory, a more significant problem remains besides the one mentioned in connection with (53). IDENT[ATR]-[σ prevents us from producing the correct harmonic forms when the root is monosyllabic:

(55)

/lè-wú/	ID[ATR]-[σ	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	AGREE
☹ a. lè-wú								*
(☞) b. lè-wú	*!							
c. lè-wʊ́						*!	*!	

$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.
$\mathbb{C}_Z$: *[–ATR, +hi]

Compare this Tableau with the Licensing-based Tableau in (56) 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 $\mathbb{C}$ constraints. This is obviously disastrous, as the correct form in this case is *lè-wú*, with regressive harmony.

(56)

/lè-wú/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	LIC-[ATR]	ID[ATR]
a. lè-wú							*!	
☞ b. lè-wú								*
c. lè-wʊ́					*!	*!		*

$\mathbb{C}_Y$: No [–ATR] spread from a [+front] vowel.
$\mathbb{C}_Z$: *[–ATR, +hi]

To correct this problem, we need yet another constraint that requires minimal spreading no matter what and outranks IDENT[ATR]-[σ.[21] 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.

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. It predicts too much spreading with roots longer than two syllables and not enough spreading in monosyllabic roots. Positional Faithfulness also requires a more complex analysis than Licensing. We need constraints to resolve the indeterminacy of (54) and to enforce minimal spreading in (55). In the end, a successful Positional Faithfulness account replicates the simpler Licensing analysis in effect but not in explanatory power or simplicity. 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 [±ATR] to the left edge of the root, and its effect must be

[21] 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.

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 and must be discarded for the same reasons that doom Positional Faithfulness.

McCarthy (2004) notes that SPREAD (Padgett 1997, 2002b, 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.

2.4.2 Optimal Domains Theory and Headed Spans

Optimal Domains Theory (ODT; Cassimjee & Kisseberth 1998, 1999b, Cole & Kisseberth 1994, 1997, 1995) 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 [αF], and such segments block the propagation of [–αF]. AGREE, ALIGN, etc., are replaced with a constraint banning adjacent (and therefore a proliferation of) feature domains. Both theories are relevant because the provide ways to mark certain segments as impervious to harmony.

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 certain 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.

However, ODT and Headed Spans are compatible with the Licensing analysis in the way described at the end of §2.3.1. The point here is that the tools that are specific to these theories are inadequate to account for Lango. ODT and Headed Spans become viable competitors to Positional Licensing only when they adopt Positional Licensing itself!

2.4.3 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 *[αF][$-\alpha$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, supplementing these constraints with Positional Faithfulness or feature co-occurrence constraints does not improve the analysis.

In an effort to produce noniterative harmony, Mahanta (to appear) elaborates on Pulleyblank's (2002) system by adding features to the conditioning constraints. Her analysis of ATR harmony in various dialects of Bengali was mentioned briefly in Chapter 1. Relevant data are repeated here.

(57)	a.	kɔt^{h}a	'spoken words'	kot^{h}ito	'uttered'
				kɔt^{h}oniyo	'speakable'
	b.	ɔʃɔt	'dishonest'	ɔʃoti	'dishonest (f)'
	c.	ʃokti	'might'		

Mahanta argues that high [+ATR] vowels induce ATR harmony on the immediately preceding vowel. Rather than adopting a constraint like *[–ATR][+ATR], she produces this harmony with *[–ATR][+high, +ATR]. Thus harmony is triggered only when the second of two mismatched vowels is high.[22]

How would this approach fare with Lango? Restricting ourselves to regressive spreading (because this is the only direction in which spreading is *prima facie* noniterative), the strategy is to identify a category of triggers such that the failure of harmony to iterate is attributable to the failure of the first iteration's target to fall into this category. Is there some requirement that all targets fail to meet that prevents them from triggering another instance of spreading?

[22]As discussed in Chapter 1, this constraint does not produce truly noniterative harmony since the lack of [+high, –ATR] vowels in the language prevent a target from becoming a trigger. That is, this harmony's noniterativity is emergent because the set of targets is distinct from the set of triggers.

A short glance at the data reveals that the answer is "no": triggers and targets do not fall into distinct categories as they do in Bengali. For example, the form *ìdîk-ê* 'leeches' (cf. *ìdíkɛ̀* 'leech') does not show spreading from the derived *i* to the underlying initial ɪ. In Mahanta's approach, this must mean that *i* is not a valid trigger. For example, we might says that the constraint that triggers harmony is *[–ATR][–high, +ATR]—only non-high vowels trigger harmony.[23] We don't find **ìdîk-ê* because the middle vowel does not meet the [–high] requirement.

But many examples demonstrate that *i* is an acceptable trigger, contrary to the claim of this constraint. To pick just one example given above, *àtín-nî* 'your (sg) child' shows spreading triggered by *i* (cf. *àtîn* 'child'). So the reason we don't find a second instance of spreading in *ìdîk-ê* is not because *i* is an invalid trigger.

Perhaps the problem lies in the target: **ìdîk-ê* is incorrect because the initial vowel is an illicit target. A constraint like *[–high, –ATR][+ATR] can reflect this—only non-high vowels undergo harmony. This hypothesis is also falsified by *àtín-nî*, where the medial vowel, /ɪ/, falls outside the set of targets as determined by the new constraint yet still harmonizes. Furthermore, *ìdîk-ê* itself shows that this is not the correct approach: /ɪ/ is a possible target.

We could appeal to the intervening consonants: Maybe we can't spread across *d*. Our constraint could be something like *[–ATR][non-/d/][+ATR]. I know of no examples with spreading across *d* specifically, but *ìdîk-ê* itself shows spreading across a stop, and *bɔ̀ŋó-ní* 'your (sg) dress' shows spreading across a voiced coronal, so the evidence suggests that *d* is probably not a blocker. In any case, our harmony-driving constraint has become very bizarre: Why would an AGREE

[23]Instead of inserting [–high] into the constraint, we could insert [+back] or any other feature that eliminates *i*, and the argument made here would still be valid.

constraint (which is what these feature co-occurrence constraints amount to) care about non-ATR features of the consonant between the harmonizing vowels? It should be clear that introducing requirements about the structure of the target or trigger's syllable or other factors would lead to similar awkwardness.

Other examples could illustrate the point. There is no feature that is common to all triggers and absent from all targets. The examples given above show that any vowel can be the target of harmony in the right circumstances, and therefore we cannot rein in otherwise iterative harmony by requiring triggers or targets to meet an extra requirement. Whether or not Mahanta's (to appear) analysis is correct for Bengali, it cannot be correct for Lango.

There are other reasons to be skeptical of Mahanta's analysis as it operates in Bengali. The constraint that motivates harmony, *[–ATR][+high, +ATR], seems not well-founded. The configuration [+high, +ATR] is unmarked (see the discussion above, plus Archangeli & Pulleyblank (1994) and Smolensky (2006)), so it is not clear why it would be the target of a negative constraint. And as Mahanta notes, the larger framework in which this analysis is couched suffers from the sour-grapes problem. Nonetheless, despite these questions and this analysis's inapplicability in Lango, it is possible that Mahanta has identified another type of constraint that can lead to the appearance of noniterativity. There is no reason to expect Positional Licensing to be unique in this regard.

2.4.4 Summary

This section has examined a number of alternatives to the Licensing analysis. All the rival approaches are faulty and must be rejected. Only Licensing achieves

both explanatory and descriptive adequacy. One other analysis, self-conjunction of IDENT, was not discussed here. See Chapter 1 for arguments against that approach.

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

2.5 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, as shown in (58). Underlining marks stress.

(58)	a.	bɔ̲ŋ́ó-ní ~ bɔ̲ŋ́ó-ní́	'your (sg) dress'
	b.	bɔ̲ŋ́ó-wú ~ bɔ̲ŋ́ó-wú	'your (pl) dress'
	c.	pà̲lə-ní ~ pə̲lə-ní́	'your (sg) knife'
	d.	pà̲lə-wú ~ pə̲lə-wú	'your (pl) knife'
	e.	òkwɛ̲́cé-ní ~ òkwɛ̲́cé-ní́	'bitches'[24]

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 vowels that are optionally targeted in (58) are all explicitly marked as stressed by Noonan. Also, Noonan (1992:71) shows that

[24]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.

the second vowel of a disyllabic stem (his stem-vowel suffix) is optionally deleted under suffixation. Thus *bɔ̀ŋɔ́-ná* 'my dress' may be rendered as *bɔ̀ŋŋá*. Deletion of this sort often accompanies unstressed, prosodically weak vowels, and these vowels may be severely reduced in fast speech. 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 [±ATR] to be linked to a stressed vowel, not just a root vowel. Thus the extra spreading seen in (58) isn't spreading by one extra syllable as Noonan indicates 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 **ì*cɔ̰*k-*kí* accompanies *ìcɔ̰k-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 (58). Presumably, this is because **ì*cɔ̰k-kí* is not a possible fast-speech variant. And as the attraction-to-stress analysis predicts, *ìcɔ̰k-kí* has stress on *o*, not the initial *ɪ*. Likewise, *ìmə́ɲ-í* 'your (sg) liver' (29e) is not given with the variant **ì*mə́ɲ-í* (p. 81), and the underlying *a* (which surfaces as *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 apparently incorrect **ì*cɔ̰k-kí* and **ì*mə́ɲ-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 *ìcɔ̰k-kí* and

ìmə̲ɲ-íń 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 complete harmony in fast speech, but *ìcə̲̀k-kíń* suggests that total spreading is an incorrect analysis—it's not clear why non-initial stress placement would suppress complete harmony. Instead, this form deviates from the normal pattern just as the attraction-to-stress analysis predicts. But in case fast speech does induce total spreading, there is still no need to invoke noniterativity. 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 (59). Without detailed evidence of its ranking, I assume fast-speech harmony is subject to the same conditions as "regular" harmony and rank (59) alongside LICENSE-[ATR].

(59) LICENSE-[ATR]/Stress (fast speech): In fast speech, [±ATR] features that are linked to affixes must be linked to stressed vowels.

The new Licensing constraint requires only ATR features that are linked to affixes to be licensed by a stressed vowel. We cannot require all ATR features to be linked to a stressed vowel. Since there is just one stressed vowel in a word, the more general version of (59) would effectively require complete harmony because only one ATR feature can be licensed. Limiting this constraint's force to affix-linked vowels is not unprincipled: While all unlicensed ATR features may be at least somewhat non-prominent, unlicensed affix features are especially non-prominent, as argued above and in Chapter 3. Like the Licensing constraint that produces

Chamorro umlaut in the next chapter, the constraint in (59) bans the worst of the worst (WOW; see Chapter 3) by requiring only especially non-prominent features to be licensed rather than all features.

The Tableau in (60) 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 evaluated the normal-speech version of this word, candidate (b) was optimal because it satisfied LICENSE-[ATR] while minimally violating IDENT[ATR]. With LICENSE-[ATR](fast speech) active in (60), 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[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.

(60)

/bòŋó-ní/	$\mathbb{C}_1$	$\mathbb{C}_2$	$\mathbb{C}_3$	$\mathbb{C}_X$	$\mathbb{C}_Y$	$\mathbb{C}_Z$	LIC-root	LIC fast	ID
a. bo̲ŋó-ní							*!	*!	
b. bo̲ŋó-ní								*!	*
☞ c. ˈbo̲ŋó-ní									**
d. bo̲ŋó-ní						*!			*

$\mathbb{C}_Z$: *[–ATR, +hi]

Notice that licensing by a morphological unit is required under normal speech, but licensing by a prosodic head is required in fast speech. Perhaps this is not an

accident. Speech rate is a prosodic property, so it should not be surprising that altering an utterance's prosodic properties activates a new prosodic constraint.[25]

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.

2.6 Akposso

Anderson (1999) gives a detailed description of ATR harmony in Akposso. Some of her data suggest that this harmony is noniterative, and in many ways the system is reminiscent of Lango. We will see, though, that (like Lango) the harmony is iterative, and the cases of apparent noniterativity are attributable to two exceptional morphemes and a Positional Licensing constraint of the sort that was used in the analysis of Lango above. The applicability of Positional Licensing to Akposso lends support to the analysis of Lango developed in this chapter.

According to Anderson, Akposso has the same vowel inventory as Lango (i.e. *i, e, ə, o, u* are [+ATR], and *ɪ, ɛ, a, ʊ, ɔ* are [–ATR]). Roots are fully harmonic:

(61) a. *[+ATR] Roots*

ísí	'yam'	únà	'type of fruit'
ínē	'animal trail'	íkó	'box'
úgbe	'grasslands'		

[25] I thank Junko Ito for pointing this out to me.

b. *[–ATR] Roots*

ʊ́fɪ	'marriage'	ʊ́nā	'type of trap'
ɔ́vɛ̂	'sun'	ɛ́kʊ́	'thing'
ɔ́tá	'rabbit'		

Each non-low vowel from one harmonic group alternates with the vowel at the same height and backness from the other group (e.g. $e \sim \varepsilon$, $u \sim \upsilon$). However, the distribution of ə is limited: It cannot occur word-initially, nor does it appear as *a*'s harmonic counterpart in affixes. Instead, *a* alternates with *e*. Harmony is root-controlled, so it is not easy to determine whether *a* alternates with ə root-internally.

Some of the data that make Akposso's harmony look noniterative are given in (62). In these forms, the first morpheme is the third-person subject prefix, the second is the incompletive aspect morpheme, and the third is the root.

(62)

a.	á-ká-tɛ́	'they are building a nest'
	á-ká-dá	'they are vomiting'
	á-ká-kpɔ	'they are hitting'
b.	á-ké-lî	'they are closing'
	á-ké-ɣlé	'they are taking the roof off'
	á-ké-gbə́	'they are borrowing'

In (62a), the roots have [–ATR] vowels, and both prefixes unsurprisingly surface with [–ATR] vowels themselves. But in (62b), the roots have [+ATR] vowels, and this time only the incompletive morpheme harmonizes. We might deduce from these forms that ATR harmony is noniterative. The ATR feature spreads to

the vowel to the immediate left of the root and no farther. The subject prefix is underlyingly [–ATR], so the apparent exhaustive harmony in (62a) is coincidental.

In fact, it appears that this is exactly the kind of data that could doom the analysis of Lango. The Licensing analysis predicts that when two suffixes appear in a form, progressive harmony should target both of them. The only such configuration I am aware of in Lango is the benefactive construction. But the benefactive suffix, it was argued above, does not harmonize with roots at all, so the prediction could not be tested. In Akposso, although we're dealing with prefixes instead of suffixes, we have data with multiple affixes, and only the one adjacent to the root harmonizes. It appears, therefore, that Akposso provides crucial evidence for true noniterativity.

This would be the wrong conclusion to draw, however. The data in (63) show iterative harmony in the same construction, but this time with the second-person singular subject prefix.

(63)	a.	ɛ-ká-tɛ́	'you are building a nest'
		ɛ-ká-dá	'you are vomiting'
		ɛ-ká-kpɔ	'you are hitting'
	b.	e-ké-lî	'you are closing'
		e-ké-ɣlé	'you are taking the roof off'
		e-ké-gbə́	'you are borrowing'

Now the subject morpheme harmonizes with both [+ATR] and [–ATR] roots. The ATR feature spreads iteratively from the root to both morphemes. In fact, Anderson (1999) attributes the apparent noniterativity in (62) to exceptionality

in the third-person plural subject morpheme. This is the only subject prefix that does not harmonize:

(64)

a.	nɪ-ká-kpɔ	'I am hitting'
	ni-ké-kû	'I am driving'
b.	ɛ-ká-kpɔ	'you are hitting'
	e-ké-kû	'you are driving'
c.	ɔ́-ká-kpɔ	'he is hitting'
	ó-ké-kû	'he is driving'
d.	wʊ-ká-kpɔ	'we are hitting'
	wu-ké-kû	'we are driving'
e.	mɪ-ká-kpɔ	'you (pl) are hitting'
	mi-ké-kû	'you (pl) driving'
f.	á-ká-kpɔ	'they are hitting'
	á-ké-kû	'they driving'

These data show that the apparent noniterativity in (62) is caused by an exceptional morpheme. The subject morpheme in those forms must be lexically marked as impervious to vowel harmony.[26]

The iterative nature of Akposso's harmony is also seen clearly in the imminent future, where both vowels preceding the root harmonize:[27]

[26]That this is a morphological exception and not a language-wide exemption of *a* from harmony is shown by the incompletive affix, which itself contains an alternating *a*.

[27]Anderson (1999) transcribes this subject morpheme as [m^{j}] before a vowel regardless of the harmonizing context, but she states that the vowel"remain[s] distinct at slower rates of speech, [m^{ɪ}]∼[m^{i}]" (p. 198, fn. 10). Before a consonant, as shown in (64), the vowel is unreduced. Anderson's data include pre-reduced forms, so it is quite clear which vowel quality is present in each example. To make the harmony obvious, I give [m^{ɪ}] or [m^{i}] instead of Anderson's [m^{j}].

(65) a. mᵻ-à-tʃí 'you (pl) will cut'
mᵻ-à-tɛ́ 'you (pl) will build a nest'
mᵻ-ă-kpɔ 'you (pl) will hit'
b. mⁱ-ĕ-mli 'you (pl) will get up'
mⁱ-è-ɣlé 'you (pl) will take the roof off'
mⁱ-è-kú 'you (pl) will drive'

Apparent noniterativity arises in other contexts in Akposso, and in these cases it is the aspectual affix that blocks iterative spreading. But whereas the exceptional subject prefix does not undergo harmony, the aspect morphemes harmonize but don't let harmony propagate to preceding prefixes. Anderson (1999:206) states that "in the aspectual sequence, only the syllable directly preceding the verb root harmonizes." That is, when one or more aspectual morphemes are present, only the last vowel of the last aspectual morpheme harmonizes. This is illustrated below with the predictive *bá∼bé* 'to come' and the prefix /à/ (for which Anderson (1999) provides no gloss, although she says (p. 199) that it "is presumably the same morpheme that is used with the imminent future"):

(66) a. mᵻ-à-bá-tʃí 'you (pl) will cut (one day)'
mᵻ-à-bá-tɛ́ 'you (pl) will build a nest (one day)'
mᵻ-à-bá-kpɔ 'you (pl) will hit (one day)'
b. mᵻ-à-bé-mli 'you (pl) will get up (one day)'
mᵻ-à-bé-ɣlé 'you (pl) will take the roof off (one day)'
mᵻ-à-bé-kú 'you (pl) will drive (one day)'

These examples contrast clearly with (65). Neither vowel that precedes the

predictive morpheme harmonizes in (66b), and the apparent harmony in (66a) is coincidental in that the prefixes' underlying features match the harmonizing feature without spreading. The predictive morpheme itself harmonizes, but it prevents the other prefixes (which, as we saw in (65), can undergo harmony) from harmonizing. In particular, the /à/ prefix cannot harmonize—just the last aspectual vowel harmonizes. How to account for these facts is taken up below.

All aspectual morphemes harmonize when final in the aspectual sequence except the repetitive morpheme (*na-ʧ́ɪ́-jɛ̀* 'I've eaten again' vs. *na-ʧ́ɪ́-bɔ̌* 'I've uprooted again'). Like the subject prefix *a-*, the repetitive morpheme is lexically tagged as non-alternating. Otherwise, aspectual morphemes harmonize when they're adjacent to the root. The morpheme *kɔna* (the form of the incompletive morpheme that follows the negative morpheme *nà*) drives the point home:

(67)	nɪ-nà-kɔna-kpɔ	'I'm not hitting'
	nɪ-nà-kɔne-bó	'I'm not uprooting'
	nɪ-nà-kɔna-tʃí	'I'm not cutting'
	nɪ-nà-kɔne-kù	'I'm not driving'

Only the last vowel of the incompletive morpheme harmonizes. Once again, it is tempting to say that while harmony is generally iterative in Akposso, the aspectual morphology invokes noniterative harmony. This is a retreat from the position that Akposso's harmony is systematically noniterative, but it is still incorrect. ATR features spread to just one aspectual vowel, but if that target is the only vowel in the aspectual sequence, harmony can further target the subject morpheme, as was shown in (65). The correct generalization is that harmony is

iterative except that only one aspectual vowel may harmonize.

It is therefore wrong to say that harmony with aspectual morphemes is non-iterative. Harmony can target multiple vowels, even when aspectual morphemes are involved. What is prohibited is spreading within the aspectual sequence. This state of affairs is reminiscent of Shona's tone spread (see Chapter 4). There, high tones are allowed to spread iteratively as long as each iteration crosses a morpheme boundary:

(68) a. *Vá-Má-zí-mí-chéro*
2a-6-21-4-fruit
'Mr. Big-ugly-fruits' (Odden 1981:77, gloss from Myers 1997:862)

b. *Vá-Dámbudziko*
honorific-Dambudziko
'Mr. Dambudziko' (Odden 1981:76)

c. Dambudziko (proper name) (Odden 1981:76)

Like Shona's high-tone spread, Akposso's harmony is clearly iterative, and therefore it does not contradict the Emergent Noniterativity Hypothesis. This is not to say that Akposso's harmony is simple to account for, but examples like (65) show that the proper analysis cannot require noniterativity.

There are several possible analyses of Akposso's harmony, and I will sketch just one of them here. This is a Licensing analysis reminiscent of the one proposed above for Lango. But rather than requiring *all* ATR features to be linked to the *root,* we can instead require *some* ATR feature of the aspectual sequence to be licensed by the *stem* to which the aspectual sequence attaches. (We will see below why it necessary to refer to the stem, not the root.) The constraint in (69) formalizes this:

(69) LICENSE(aspect)-[ATR]: Some ATR feature from the aspectual sequence must be linked to a stem vowel.

Lango-style bidirectional harmony can be ruled out with high-ranking root faithfulness, and general faithfulnes constraints can block spreading to all but the last aspectual vowel:

(70)

/mɪ-à-bá-mli/	LIC(aspect)-[ATR]	ID[ATR]-Root	ID[ATR]
a. mᴵ-à-bá-mli	*!		
☞ b. mᴵ-à-bé-mli			*
c. mᴵ-è-bé-mli			**!
d. mᴵ-à-bá-mlɪ		*!	*

Candidate (a) violates LICENSE because no aspectual vowel shares its ATR feature with the stem. Candidate (b) spreads the [+ATR] feature of root to the last aspectual vowel, thereby satisfying LICENSE. Candidate (c) spreads this feature to both aspectual vowels and incurs an unnecessary violation of IDENT. Finally, candidate (d) spreads from the prefixes to the root, which satisfies LICENSE but runs afoul of the root faithfulness constraint. (Spreading to the first aspectual vowel, as in * *mᴵ-è-bá-mli*, is ruled out by the No Crossing Constraint (Goldsmith 1976) or any other locality requirement.)

Accounting for the subject prefixes' harmonization is simple at this point. Broadening the scope of the Licensing constraint is all that is necessary. Rather than requiring just the aspectual sequence to be licensed, we can require all affixes to share an ATR feature with the stems they attach to:

(71) LICENSE-[ATR]: Some ATR feature in each affix group must be linked to a stem vowel.

"Affix group" is used to encompass the single subject morphemes and the potentially polymorphemic aspectual sequence: One ATR feature from each of these groups must be licensed. The aspectual sequence attaches to the root, so it must share an ATR feature with the root. Subject prefixes attach to the aspect+root stem, so they must share an ATR feature with this unit.

Notice that the form in (72) satisfies the new Licensing constraint without spreading to or from the subject prefix. Since the subject prefix's vowel and the leftmost aspectual vowel are both [–ATR], no change is necessary beyond fusing these [–ATR] features into a single feature.

On the other hand, when there is just one aspectual vowel, both it and the subject prefix must change to satisfy LICENSE:

(72)

/mɪ-à-mli/	LICENSE-[ATR]	IDENT[ATR]-Root	IDENT[ATR]
a. mᵻ-ĕ-mli	*!		*
b. mᵻ-ă-mli	*!		
☞ c. mⁱ-ĕ-mli			**
d. mᵻ-ă-mlɪ		*!	*

Spreading to just the aspectual vowel (candidate (a)) is ruled out because it leaves the subject prefix unlicensed. Making no change at all (candidate (b)) means that the prefix vowel can be licensed by sharing its ATR feature with the aspectual vowel, but the aspectual vowel is itself unlicensed. Spreading to the root (candidate (d)) is once again ruled out by root faithfulness. The only solution is

to spread to both prefixes, as in candidate (c).

Spreading just once is, as in Lango, the simplest way to satisfy LICENSE in some cases. But in other cases, LICENSE is satisfied by spreading to both an aspectual affix and the subject prefix. In both Lango and Akposso, a constraint that produces seemingly noniterative spreading also motivates iterative spreading in the right circumstances.

Before leaving this section, it is worth commenting on suffixes. There are very few suffixes in Akposso, and the only one that Anderson mentions is the definite article clitic. As shown in (73), this suffix harmonizes as expected:[28]

(73)

a.	ɔ́sʲ-ɛɛ́	'the woman'
	ívlʷ-ɛ̆	'the bird'
	ɛ̀g-ɛ̆	'the money'
b.	ív́ʷ-é	'the raffia sack'
	édʲ-é	'the palm nut'
	ín̄-é	'the animal trail'

There is a free form of the definite article, *jɛ́*, which does not harmonize: *ín̄ jɛ́* 'the animal trail.' But since Akposso's harmony is lexically bound, this is not a surprise.

Akposso's ATR harmony is very similar to Lango's in that they both involve interactions between roots and affixes. The primary differences lie in which affixes participate (primarily prefixes in Akposso, exclusively suffixes in Lango), the form of the Positional Licensing constraints that account for harmony (existen-

[28] All of the roots are vowel-final, but these vowels either undergo glide formation or elision, presumably to resolve hiatus. The conditions under which lengthening occurs are not clear.

tially quantified stem-licensing in Akposso, universally quantified root-licensing in Lango), and whether or not root-faithfulness plays a role (as it does in Akposso but not in Lango).

With respect to the Emergent Noniterativity Hypothesis, Akposso is an important case study for two reasons. First, the applicability of Positional Licensing to this language's harmony system lends support for Positional Licensing as theoretical construct. Second, Akposso's harmony is a potentially truly noniterative phenomenon in its own right, and demonstrating that this noniterativity is emergent is a crucial step in supporting the ENH. This section has attempted to do just that.

2.7 Conclusion

This chapter has developed an analysis of ATR harmony in Lango grounded in Positional Licensing. Standard harmony-driving constraints like Agree and Align cannot produce the pattern found in Lango, which initially appeared to show noniterative harmony that conflicts with the ENH. But a truly noniterative analysis 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. An examination of the harmony system in Akposso supports this analysis: Akposso's harmony is driven by the same mechanisms that give rise to

Lango's harmony, and predictions of the analysis of Lango are borne out (with some language-particular differences) by Akposso.

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 a prominent position, 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 noniterativity, 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 can. But in closely examining what looked like true noniterativity 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. This investigation of Lango is the first piece of the argument in support of the ENH. If even Lango's harmony exhibits emergent noniterativity, chances are good that other seemingly noniterative phenomena are also not truly noniterative. As we will see in subsequent chapters, this speculation turns out to be correct.

More data are needed to fully test the Licensing analysis. For example, Licensing predicts that in a configuration in which [+ATR] spreads regressively from a suffix vowel that is not adjacent to the root, spreading will continue until the

root is reached. E.g., an input like /bɔŋɔ-na-ni/ should yield *bɔŋo-nə-ni*. So far I have not found a form with the appropriate configuration. The only construction I am aware of that includes two overt suffixes is benefactive verbs, which, as discussed in §2.3.2 above, show idiosyncracies that do not permit this prediction to be tested.

Another prediction, pointed out to me by Kazutaka Kurisu (p.c.), is that there should be a language with "edge-in" harmony: /i-mɔtɔka-e/ should be realized as i-motɔkə-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, which is the subject of the next chapter.

The status of Noonan's (1992) stem vowel also remains unsettled. I argued here that some instances of this morpheme are really an infinitival suffix and other instances represent a root-final vowel rather than a separate morpheme. It is clear, though, that at the very least this vowel is the remnant of a historically real suffix. More work is needed to determine the status of this vowel in the modern language, and if Noonan is correct in identifying a stem-vowel suffix, its interaction with the harmony system should be more fully investigated.

To summarize, Lango's harmony at first seemed to be a counterexample to the claim of this dissertation that there is no true noniterativity in phonology. A closer look shows that an OT account, which by necessity claimed that the harmony's noniterativity is emergent, is more empirically and conceptually satisfactory than a (truly) noniterative rule. Lango, therefore, does not challenge the ENH.