Akan vowel harmony

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Abstract

Akan, a Ghanaian language in the Kwa subbranch of the Niger-Congo family, exhibits a robust system of vowel harmony for tongue root position. Much of the research on Akan has also posited the existence of a system for rounding harmony as well. In this thesis, I argue that both systems are well-attested and highly consistent. First, I demonstrate that it is possible to produce a coherent, consistent description of Akan vowel harmony. I then examine the patterns of harmony and demonstrate that it is easily understood when its different domains - stems, prefixes, and suffixes - are examined independently. Based on this information, it is possible to demonstrate that tongue root harmony applies universally, while rounding harmony occurs directionally.

After fully describing the harmony system, I take a preliminary look at an Optimality Theory account. I compare and contrast Stem Control and Agreement theory, as proposed by Bakovic (2003), and Alignment theory, as modeled by Akinlabi (1997). On evaluation of the data, I demonstrate that Alignment explains a larger portion of the Akan data, but that Stem Control has some interesting implications for dealing with "irregular" forms.

This thesis is organized as follows: In chapter 1, I give a general overview of work on Akan phonology and on Akan orthography and vowels. In chapter 2, I give a systematic, organized description of the vowel harmony system based on the published literature. In chapter 3, I

expand on this framework using data collected from speakers. Chapter 4 presents the two Optimality Theoretic approaches to vowel harmony. Chapter 5 evaluates the effectiveness of the theories with respect to Akan data.

Acknowledgments

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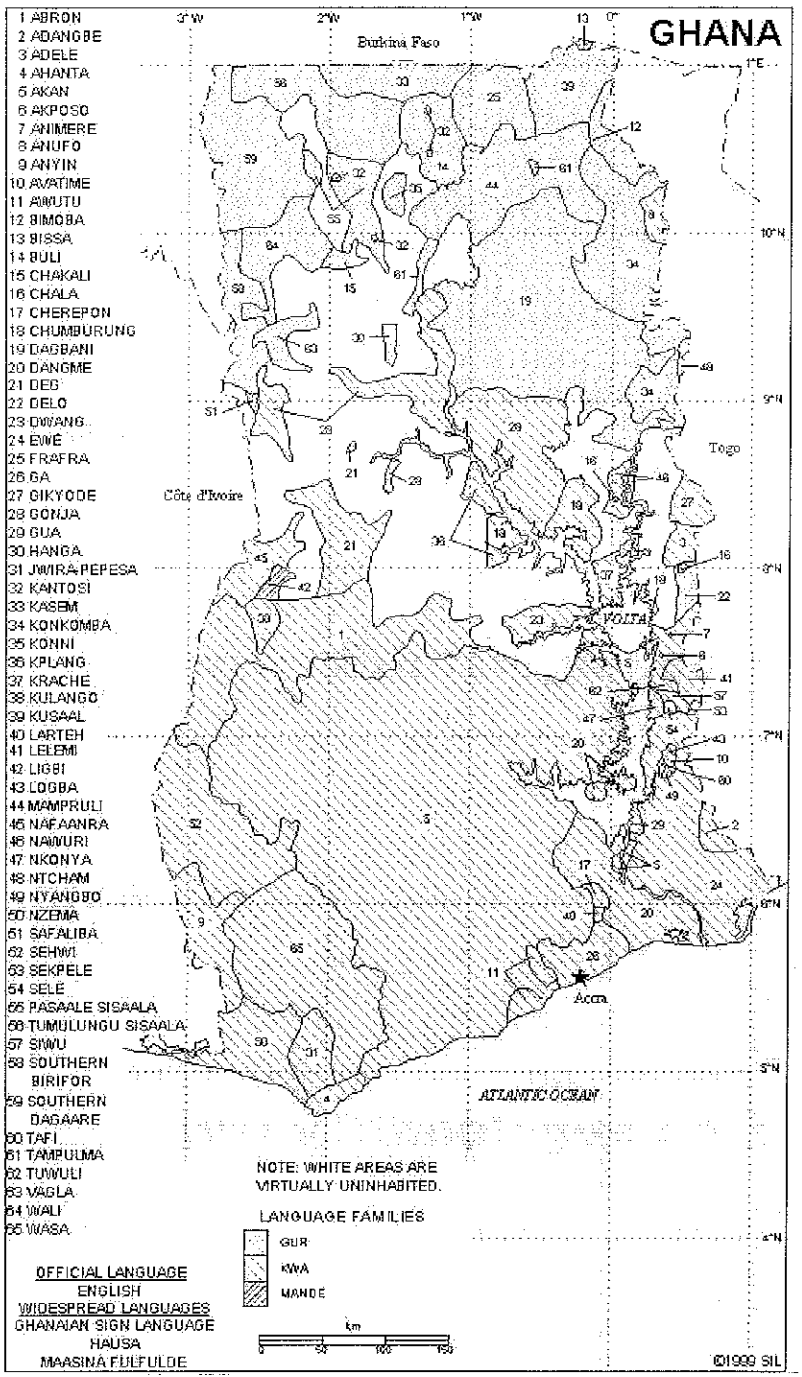
GHANA
1 ABRON
2 ADANGBE
3 ADELE
4 AHANTA
5 AKAN
6 AKPOSO
7 ANIMERE
8 ANUFO
9 ANYIN
10 AVATIME
11 AWUTU
12 BIMOBA
13 BISSA
14 BULI
15 CHAKALI
16 CHALA
17 CHEREPON
18 CHUMBURUNG
19 DAGBANI
20 DANGME
21 DEG
22 DELO
23 DWANG
24 EWE
25 FRAFRA
26 GA
27 GIKYODE
28 GONJA
29 GUA
30 HANGA
31 JWIRA-PEPESA
32 KANTOSI
33 KASEM
34 KONKOMBA
35 KONNI
36 KPLANG
37 KRACHE
38 KULANGO
39 KUSAAL
40 LARTEH
41 LELEMI
42 LIGBI
43 LOGBA
44 MAMPRULI
45 NAFAANRA
46 NAWURI
47 NKONYA
48 NTCHAM
49 NYANGBO
50 NZEMA
51 SAFALIBA
52 SEHWI
53 SEKPELE
54 SELE
55 PASAALE SISAALA
56 TUMULUNGU SISAALA
57 SIWU
58 SOUTHERN BIRIFOR
59 SOUTHERN DAGAARE
60 TAFI
61 TAMPULMA
62 TUWULI
63 VAGLA
64 WALI
65 WASA
Burkina Faso
Côte d'Ivoire
Togo
VOLTA
Accra
ATLANTIC OCEAN
NOTE: WHITE AREAS ARE VIRTUALLY UNINHABITED.
LANGUAGE FAMILIES
GUR
KWA
MANDE
OFFICIAL LANGUAGE
ENGLISH
WIDESPREAD LANGUAGES
GHANAIAN SIGN LANGUAGE
HAUSA
MAASINA FULFULDE
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Previous page: language map of Ghana, taken from http://www.ethnologue.com/

1 Background on Akan

Akan is one of the most widely-spoken languages of the Kwa subbranch of the Niger-Congo family, being the first language of approximately 44% of the population of Ghana (see previous page): some 7 million speakers, of whom the vast majority uses English as a second language. There are three major dialects of Akan: Asante, Akuapem, and Fante[1]. Akuapem and Fante form a subgroup of Akan called Twi[2]; however, the three dialects are all mutually intelligible. Modern Akan is written in a Roman orthography. There are two main variations on the orthography: one which shows diacritics corresponding to advanced and retracted tongue root position, and one which omits the diacritics. Furthermore, each dialect is spelled phonetically, although attempts have been made at a Unified Akan Orthography. For the sake of clarity, I will break with most of the available literature and use the International Phonetic Alphabet whenever possible.

Considering its relatively prominent status and complex phonology, Akan still remains a rather poorly-documented language. Current research on Akan remains not only minimal but also rather fragmentary. Very little descriptive material exists, and what does exist is often fairly non-systematic. J. M. Stewart's 1967 "Tongue root position in Akan vowel harmony" is the decisive work on ATR harmony in Akan. Although it provides a strong argument for the existence of such a system, it does little to describe or explain Akan harmony.

Florence Abena Dolphyne published in 1988 what remains probably the most comprehensive

[1]Spelling of these three dialects seems to vary somewhat wildly. I will use the spellings presented here, as they are the closest to the Akan orthography.

[2]Akan is sometimes referred to as Twi-Fante, but this is a generally archaic name.

work on Akan phonology, *The Akan (Twi-Fante) language: Its sound systems and tonal structure.* This book is an excellent source of phonological data in Akan. Unfortunately, though, it manages to raise more questions than it answers. The book gives an extensive description of vowel harmony, but it is a very confusing one and tends to have more exceptions than rules. Further, as Dolphyne's goal is descriptive accuracy rather than predictive generalization, this work is an excellent source of data but an inadequate theoretical framework. My main goal in chapter 2 is to build on the work presented in Dolphyne 1988 and develop a more descriptive, predictive model.

2 Akan vowel harmony described

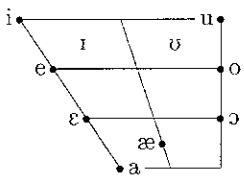
Vowel harmony can be defined as a set of systematic co-occurrence restrictions. In other words, a language exhibiting vowel harmony will generally have two sets of vowels whose co-occurrence is highly marked. Akan in fact has two varieties of harmony: tongue root position and lip rounding. The processes behind these systems are not readily obvious. Previous work on the language provides compelling evidence that such a system does in fact exist, but a truly systematic and organized account has yet to be published. Berry (1957) and Stewart (1967) successfully identify [ATR] as a harmonic factor, but neither addresses rounding harmony. Dolphyne (1988) presents the largest range of data on vowel harmony. Her account, however, fails to point out the general patterns which I present in this chapter.

Although there is strong consistency through the language - once the system is described adequately, it can be shown to be uniformly accurate - there are enough seeming "exceptions" that Akan harmony can initially appear to be a deeply irregular process. In this chapter I hope to illustrate the harmony system in such a way that harmonic patterns in Akan can be accurately predicted. To understand the harmony system, let us first consider the vowels of Akan.

2.1 Akan vowels

Akan has a reasonably complex vowel space. It has fewer vowels than English but more than many other Ghanaian languages, such as Gã.

(1)



The back vowels, u, ʊ, o, and ɔ are rounded. All others are unrounded. Since [+back] and [+round] refer to the same set of vowels in Akan, some theorists have observed rounding harmony in Akan, whereas others have termed the same patterns backness harmony. For the sake of consistency with Dolphyne and most of the recent work on Akan, I will treat this system as rounding harmony. However, it is important to remember that the terms are essentially interchangeable with regards to Akan.

The vowels i, e, æ, o, and u are articulated with the tongue root advanced (for now, I will refer to these as the [+ATR] vowels). The vowels ɪ, ɛ, a, ɔ, and ʊ are unadvanced ([-ATR]). The low vowel /æ/ does not occur in Fante. Furthermore, it most frequently is manifested as /a/. This has led many linguists to treat it, when it occurs, as a variant of /a/.

Akan vowels are paired with respect to the feature [±ATR]. Retraction of the tongue root (corresponding to [-ATR]) results in a slight lowering of the particular vowel. As such, we can follow Dolphyne 1988 and posit that Akan has five underlying vowels: high front (i/ɪ), mid front (e/ɛ), low central (æ/a), mid back (o/ɔ), and high back (u/ʊ). Two pieces of evidence support such a division. First, consider the various historical orthographies of Akan, as shown:

(2)

Gold Coast	UAO	IPA
i̩	i	i
e̩	e	e
a	a̩	æ
o̩	o	o
u̩	u	u
i	e̩	ɪ
e	ɛ	ɛ
a	a	a
o	ɔ	ɔ
u	o̩	ʊ

The marking of diacritics in the (now-archaic) Gold Coast script clearly correspond to [±ATR] distinctions. The modern Unified Akan Orthography does not reflect the pairings quite so explicitly, but there is still clearly some knowledge of this distinction in mind. The diacritics are often omitted in the modern orthography, but fluency in Akan (i.e. knowledge of vowel harmony) allows disambiguation.

The second piece of evidence justifying the [+ATR]/[-ATR] pairings is the data presented in the remainder of this chapter.

Dolphyne (1988) argues that Akan undergoes harmony with respect to both tongue root position and lip rounding. Both types of harmony clearly take place; as evidence, and as a step towards developing a systematic understanding, let us now exhaustively examine all the different domains at which harmony occurs. All actual data for the rest of this section, unless otherwise noted, is from Welmers 1946, Dolphyne 1988, Dolphyne 1996. Analysis is my own, although I am generally following the order used by Welmers 1946 and the terminology used by Dolphyne 1988.

2.2 Harmony: stems

Harmony within stems is well-attested with regards to [ATR]. We can quite clearly observe consistent co-occurrence restrictions, at least with regards to [ATR], within stems. Consider the following:

(3)	+ATR		-ATR	
	efie	'home'	ɛfiɛ	'vomit'
	kasa	'language'	kɛsɪ	'large'
	adi	'outside'	adɪ	'thing'
	owu	'death'	ɔwʊ	'snake'
	koko	'chest'	kɔkɔ	'crab'
	bosome	'month/moon'	ɛtʊrɔ	'lie'
	kun	'husband'	kʊn	'neck'

As can be seen from the above examples, there is certainly good cause to accept the existence of tongue root harmony in stems.

Harmony is, however, not without its exceptions. Within stems, there are two consistent violators of harmony. The first is the low vowel /a/. In a large number of stems, /a/ occurs at the right edge of the word and violates harmony with the first syllable. Consider:

(4)	bisa	'ask'	biara	'any'
	kura	'hold'	mogʲa	'blood'
	dua	'free'	sekan	'knife'

The other harmony violator is /ɛ/, although it violates vowel harmony far less frequently. Dolphyne (1988) argues that this is due to the alignment of vowels; however, disharmonic /ɛ/ only appears to occur after palatalized consonants, as in:

(5) pinkʲɛ 'come close'
nʲinsɛn 'be pregnant'

There is no clear reason why /ɛ/ should behave differently in such a context, particularly considering that the proximity of the palatalized consonant appears not to matter.

Rounding harmony does not apply to stems. The forms below are fully grammatical:

(6)	owu	'death'	ɛwʊ	'honey'
	bɔnɪ	'evil'	asɔrɪdan	'chapel'
	ankʊrɛ	'barrel'	kubɛ	'coconut'

The astute reader may note that despite the relatively large number of counter-examples, Akan stems appear to have a general tendency to contain all rounded or all unrounded vowels, with the exception of /a/. I will return to this issue in chapters 4 and 5.

I will now consider harmony at the level of affixes. Akan stems are generally quite short, and words often have a large number of affixes. For this reason, the interplay of harmony and affixation provides valuable information. The vowel-containing prefixes and suffixes of Akan are shown below[3]. I will consider each affix in turn.

(7)

Verbal prefixes	Pronominal	mi/mɪ, wu/wʊ, i/ɪ, o/ɔ, ye/yɛ, wo/wɔ
	Future	be/bɛ/bo/bɔ
	Progressive	ri/rɪ/ru/rʊ
	Perfect	a
	Ingressive	be/bɛ
	Egressive	ko/kɔ
Nominal prefixes	Singular	V
Verbal suffixes	Past	i/ɪ/yɛ
	Nominalizing	i/ɪ
Nominal suffixes	Asante nominal	e/ɛ/o/ɔ
	"Person"	ni
	Diminutive	wa/ba
	Personal plural	fʊ
	Kinship plural	nʊm

2.3 Harmony: prefixes

2.3.1 The pronominal prefixes

Personal pronouns prefix to verbs in Akan; there is clear harmonic behavior here[4]:

[3]Note that I am only considering those affixes that contain vowels. Welmers (1946) and Dolphyne (1988) list a number of other affixes, but they are not relevant here.

[4]The articulation of 'you eat' as /idzi/ in Fante is not due to a phonological alternation; rather, Fante has different forms for both the second person singular prefix and the verbs 'eat' and 'call'.

(8)	di 'eat'	mi.di 'I eat'	dɪ 'be called'	mɪ.dɪ 'I am called'
		wu.di 'you eat'		wʊ.dɪ 'you are called'
		i.dzi (Fante)		ɪ.dzɪ (Fante)
		ɔ.di 'he eats'		ɔ.dɪ 'he is called'
		ye.di 'we eat'		yɛ.dɪ 'we are called'
		wo.di 'they eat'		wɔ.dɪ 'they are called'

We can generalize these data by saying that the pronominal prefix consists of a distinct consonant/vowel pair, for which [+ATR] and [-ATR] variants occur depending on environment.

2.3.2 The future prefix

The future prefix generally occurs closest to the verb stem, at least in terms of vowel-containing affixes (the negative prefix /n/ can follow it). In Akuapem and Asante, it is either /be/ or /bɛ/, corresponding to the [ATR] value of the verb stem:

(9)	ɔ.bɛ.kʊ	'he will fight'	o.be.tu	'he will dig it up'

Our generalization here is that the future prefix in the Twi dialects is /bV[+mid, +front]/, for which [+ATR] and [-ATR] variants exist.

In Fante, however, the future prefix can also be /bo/ and /bɔ/. It agrees with the stem with regards to both tongue root position and lip rounding:

(10)	ɔ.bɔ.kʊ	'he will fight'	o.bo.tu	'he will dig it up'
	o.be.dzi	'he will eat it'	m.ɔkɔ	'I will go'

The voicing of 'I will go' as /mɔkɔ/ rather than /mɪbɔkɔ/, as would be expected, is due to a general elision rule applying only to the first person singular future tense. With Fante, we can

generalize the future prefix as /bV[+mid]/, for which variants occur with respect to [±ATR] and [±round].

2.3.3 The progressive prefix

In Asante, the progressive prefix simply consists of a lengthened vowel preceding the verb stem:

(11)	ɔ.ɔ.kɔ	'he is going'	o.o.tu	'he is digging it up'
			o.o.bisa	'he is asking'

This is, of course, always harmonic.

In Akuapem, however, the progressive morpheme is always articulated as /rɪ/, regardless of the [ATR] value of the stem. Furthermore, prefixes to the left of the progressive share its [-ATR] value:

(12)	ɔ.rɪ.kɔ	'he's going'	ɔ.rɪ.tu	'he is digging it up'
			ɔ.rɪ.bisa	'he's asking'

In Fante, the progressive prefix can be articulated as /ru/, /rʊ/, /ri/, and /rɪ/. It agrees with the stem in both rounding and tongue root.

(13)	ɔ.rʊ.kɔ	'he is going'	o.ru.tu	'he is digging it up'
	ɔ.rɪ.dɪ	'he is being called'	o.ri.bisa	'he is asking'

We can generalize the Fante progressive prefix as /rV[+high]/, for which variants occur with respect to [±ATR] and [±round]. Note that this information is consistent with the future prefix; Fante appears to exhibit rounding harmony in addition to tongue root harmony.

2.3.4 The perfect prefix

The perfect prefix in all dialects consists of the low vowel /a/. As with the Akuapem progressive morpheme, it is always articulated as /a/, regardless of the harmonic value of the stem:

(14)	m.a.ba	'I have come'	ɔ.a.tu	'he has dug it up'
	ɔ.a.tɔ	'he has baked'		

Note that there is elision of the personal prefix again; /m/ is of course derived from /mi/mɪ/. Also note that the perfect prefix, as Dolphyne (1988) points out, is the only verbal prefix which does not display rounding harmony in Fante (although this is unsurprising, as there is no [+round] correspondent to /a/).

2.3.5 The ingressive prefix

The ingressive prefix (which indicates action moving towards the speaker, such as /o.be.di/ 'he comes and eats it') is phonetically and phonologically indistinguishable from the future prefix (cf. 2.3.2). In all dialects, it agrees with the following vowel in terms of ATR; in Fante it also agrees in terms of rounding.

(15)	o.be.di (Ak, As)	o.be.dzi (F)	'he comes and eats it'
	o.be.tu (Ak, As)	o.bo.tu (F)	'he comes and digs it up'
	ɔ.bɛ.kʊ (Ak, As)	ɔ.bɔ.kʊ (F)	'he comes and fights'

2.3.6 The egressive prefix

The egressive prefix (indicating action moving away from the speaker) behaves identically to the the ingressive and future prefixes. In Akuapem and Asante, it is pronounced as /ko/ or /kɔ/

depending on the tongue root position of the stem vowel.

(16)	o.ko.tu (Ak, As)	o.ko.tu (F)	'he goes and digs it up'
	ɔ.kɔ.fa (Ak, As)	ɔ.kɛ.fa (F)	'he goes and takes it'
	o.ko.di (Ak, As)	o.ke.dzi (F)	'he goes and eats it'

We may thus generalize the egressive prefix as follows: In the Twi dialects, it is /kV[+mid, +back]/, where the value of [ATR] agrees with the verb stem; in Fante, it is /kV[+mid]/, for which variants occur with respect to [±ATR] and [±round].

2.3.7 The singular prefix

What Dolphyne (1988) terms the "singular nominal prefix" agrees with the following vowel in terms of [±ATR]:

(17)	e.ti, i.tsir	'head'	a.daka	'box'
	o.hia	'poverty'	ɛ.ban	'herring'

However, there is a great deal of complexity in terms of precisely which harmonic vowel will occur - in fact, there is seemingly no correlation, other than agreement in [ATR]. Osam (1993) attributes the wild variation to the decay of a semantic noun class system in Proto-Akan. He predicts that the current Akan language is developing towards a cohesive system of plural marking. Osam's findings call into question the classification of these initial vowels as "prefixes". It is thus reasonable to consider these vowels part of the root, or at the very least, morphological entities which have not yet separated into true prefixes. Considering this information, it is acceptable that the place of articulation of the singular nominal prefix is not easily predicted; [ATR] is the only value we can predict.

2.4 Harmony: suffixes

2.4.1 The past suffix

Akan has only one verbal suffix. In Akuapem and Fante, when past tense verbs are not followed by an object, they are suffixed with either /i/ or /ɪ/, agreeing with the [ATR] value for the stem.

(18)	ɔ.tɔ.ɪ	'he bought it'	o.n.tu.i	'he has not dug it up'
	ɔ.paɯ.ɪ	'he sewed it'		

Note that the past suffix does not agree with regards to rounding in Fante.

Asante exhibits two possible forms. With either form, the final vowel of the stem is lengthened. The first form of the suffix is identical to that for Akuapem and Fante (thus /ɔtɔɔɪ/, /ontuui/). The second form is /yɛ/:

(19)	ɔ.tɔɔ.yɛ	'he bought it'	o.n.tuu.yɛ	'he has not dug it up'

This past suffix does not necessarily agree with the rest of the word.

When the verb stem ends in a consonant, the Asante past suffix becomes either /ʊ:yɛ/ or /ɪ:yɛ/, based on the value of [±round] for the stem:

(20)	ɔ.tɔn.ʊ:yɛ	'he sewed it'	ɔ.kan.ɪ:yɛ	'he read it'

Note, now, that we can observe rounding harmony in Fante, but only in prefixes; we can observe rounding harmony in Asante, but only in suffixes.

2.4.2 The nominalizing suffix

Akuapem and Asante have a nominalizing suffix (attached to verb stems) which is voiced as /i/ or /ɪ/, in agreement with the [ATR] value of the preceding vowel:

(21)	wie	'finish'	a.wie.i	'the end'
	tɔ	'to fall'	a.tɔ.ɪ	'west'

The nominalizing suffix in Asante is voiced as /iɛ/ or /ɪɛ/, in agreement with the [ATR] value of the preceding vowel:

(22)	wie	'finish'	a.wie.iɛ	'the end'
	tɔ	'to fall'	a.tɔ.ɪɛ	'west'

Note that the final /ɛ/ never varies, and thus can result in disharmony.

2.4.3 The Asante nominal suffix

Asante has a second nominal suffix, for which Akuapem and Asante have no analogous suffix. It attaches to noun stems ending with high vowels. This suffix is a mid vowel - /e/, /ɛ/, /o/, or /ɔ/ - agreeing with the final stem vowel's values for [ATR] and [round]:

(23)	esi.e	'anthill'	owu.o	'death'
	adɪ.ɛ	'thing'	ɛwʊ.ɔ	'honey'

Asante nouns ending in other vowels have no similar suffix.

2.4.4 The "person" suffix

Akan nouns suffixed with /ni/ take on a personal meaning[5].

(24)	latɛ	'Larteh' (town)	late.ni	'citizen of Larteh'
	sika	'money'	o.sikæ.ni	'rich person'

Note that in each of the examples presented above, the vowel preceding /ni/ is [+ATR] in the affixed form but [-ATR] in the unaffixed version. Dolphyne (1988) reports that /ni/ is derived from /oni/ 'person', which suggests that perhaps these words derive from compounds in which vowel elision takes place.

2.4.5 The diminutive suffix

Akan nouns may be suffixed with /wa/ as a diminutive. The form of this suffix never changes.

(25)	kuro	'town'	kuro.wa	'village'
	asaː	'cotton'	asaː.wa	'cotton-wool'

Fante nouns may also be suffixed with a "feminine" diminutive morpheme (thus termed by Dolphyne) /ba/. It should be noted that the lexical semantics involved in this suffixation are not readily apparent to non-speakers. This suffix never changes.

(26)	dɔn	'bell'	a.dɔm.ba	'small bell'

[5]These data, from Dolphyne 1988, directly refute a claim in the same work that only [-ATR] vowels can precede /æ/.

Note that the change of /n/ to /m/ is due to place-of-articulation assimilation in nasals. This is a pattern persistent across the entire language.

2.4.6 The personal plural suffix

Nouns are generally marked as plural through a plural prefix, but some personal nouns additionally take the plural suffix /fʊ/. It is always [-ATR].

(27)	ɔ.panʲin	'elder'	m.panʲim.fʊ	'elders'
	o.sika.ni	'rich person'	a.sika.fʊ	'rich people'

Note that /mpanʲimfʊ/ displays place-of-articulation assimilation for nasals.

2.4.7 The plural kinship suffix

Nouns of kinship are marked as plural with /nʊm/. It is always [-ATR].

(28)	kunu	'husband'	kunu.nʊm	'husbands'
	agʲa	'father'	agʲa.nʊm	'fathers/elders'

2.5 Consistent patterns in harmony

The following table shows every vowel-containing morpheme in Akan, and whether it harmonizes:

(29)

Morpheme	Akuapem	Asante	Fante
Stems	ATR	ATR	ATR
Prefixes			
Pronominal	ATR	ATR	ATR
Future	ATR	ATR	ATR, Rounding
Progressive	No	N/A	ATR, Rounding
Perfect	No	No	No
Ingressive	ATR	ATR	ATR, Rounding
Egressive	ATR	ATR	ATR, Rounding
Suffixes			
Past	ATR	ATR, Rounding	ATR
Nominalizing	ATR	ATR	ATR
Nominal		ATR, Rounding	
"Person"	No	No	No
Diminutive	No	No	No
Personal plural	No	No	No
Plural kinship	No	No	No

Examining the data above, we can safely draw a number of conclusions. All three dialects are clearly harmonic for tongue root position; the exceptional cases are infrequent and potentially explainable (chapters 4 and 5). Tongue root harmony is bidirectional.

We also can now enumerate the consistent causes of tongue root harmony violations. The first is the low vowel /a/. This occurs in stems, in the perfect prefix, and in the diminutive suffix. Other than the perfect morpheme (which consists of the disharmonic vowel /a/), all violations to tongue root harmony occur in nominal suffixes, all of which are consonant-initial. /a/ is disharmonic, but

fully predictable. The only relatively unpredictable disharmonic entity is /ɛ/ in the presence of a palatalized consonant.

Harmony for lip rounding is a persistent enough pattern that Asante and Fante can said to be harmonic for it as well. In Asante, rounding harmony applies only to suffixes (rightward). In Fante, it applies only to prefixes (leftward). Akuapem, however, has no rounding harmony system.

In Fante, all prefixes harmonize for rounding except the pronominal prefixes; in other words, verbal prefixes harmonize but nominal prefixes do not. In Asante, rounding only occurs in one verbal suffix and one nominal suffix. It does not apply in the nominalizing suffix (verbal) or any consonant-initial nominal suffix.

3 Expanding on the literature

In this chapter, I will present descriptive information that I gathered from conversations with two speakers of Akan. The first was a native speaker of the Akuapem Twi dialect, from Accra, Ghana. The second, also from Accra, was a native speaker of the Fante dialect.

My first goal was to confirm the patterns I describe in chapter 2. This was done with little difficulty. I was readily able to reproduce responses corresponding to the chart in (29). First, to ensure accurate recording of vowels on my part, I asked each speaker to read the following passage in Unified Akan Orthography, as presented in Dolphyne 1988:

Kookoo nkɔso no fi adikanfo no, asaase pa, ɔmandwoe ne aguadi ne ɛmu sikapɛ, ne sikaanibere ne adepɛ de, nanso ɛfi ɔmanfo no ankasa mbɔdenbɔ nso. Wɔambɔ wɔn ho mbɔden amfa anigeden anyɛ a, anka ankosi hwee.

Next, I asked each speaker to give me the Akan word corresponding to the glosses presented below; responses are as follows:

(30)

English	Ak: literature	Ak: observed	F: literature	F: observed
language	kasa	kasa	kasa	kasa
large	kɛsɪ	kɛsɪ	kɛsɪ	kɛsɪ
outside	adi	adi	adi	adi
thing	adɪ	adɪɛ[1]	adɪ	adɪ
husband	kʊn	kʊn	kʊn	kʊn
neck	kʊn	kʊn	kʊn	kʊn
God	onʲamɪ	onʲamɪ	onʲamɪ	onʲamɪ
ask	bisa	bisa	bisa	bisa
fight	kʊ	kʊ	kʊ	kʊ
dig up	tu	tu	tu	tu
go	kɔ	kɔ	kɔ	kɔ
eat	di	di	di	di
be called[2]	dɪ	dɪ	dɪ	dɪ
see	hu	hu	hu	hu
I eat	midi	midi	midzi	midzi
he eats	odi	odi	odzi	odzi
I am called	mɪdɪ	mɪdɪ	mɪdzɪ	mɪdzɪ
he is called	ɔdɪ	ɔdɪ	ɔdzɪ	ɔdzɪ
he will go	ɔbɛkɔ	ɔbɛkɔ	ɔbɔkɔ	ɔbɔkɔ
he will dig up	obetu	ɔabetu[3]	obotu	obotu
he is going	ɔrɪkɔ	ɔrɪkɔ	ɔrʊkɔ	ɔrɔkɔ[4]
he is asking	ɔrɪbisa	ɔrɪbisa	oribisa	oribisa
he went	ɔkɔɪ	ɔkɔɪ	ɔkɔɪ	ɔkɔɪ
he saw it	ohui	ohuuyɛ[5]	ohui	ohui
Larteh	latɛ	latɛ	latɛ	laːtɛ
citizen of Larteh	lætɛni	læteni	lætɛni	latɛnɪ[6]

Notes

1 - This is an Asante form.

2 - This gloss was insufficient for eliciting the right response from speakers; I had to attempt my own pronunciation.

3 - This actually corresponds to 'he will have dug it up', in a manner predicted by the description presented in chapter 2.

4 - This displays the expected values of [-ATR] and [-round], despite being anomalous.

5 - This is an Asante form.

6 - This is not the predicted response, but obeys tongue root position harmony.

The data presented above provides ample evidence to confirm the patterns I have described in chapter 2. Note that the Akuapem speaker's responses are something of a fusion of the predicted forms for Asante and for Akuapem. This is an unproblematic and unsurprising finding; both are Twi dialects and thus have a fair amount of geographical overlap.

I asked speakers for Akan pronunciations of several loanwords, to examine the patterns of vowels:

(31)

English	**Akuapem**	**Fante**
America	amɪrka	amrɪka
Washington	ɔaʃɪntɔn	ɔaʃɪntʊn
government	gɔvmɪnt	gɔvmɪnt
California	ka:fɔrnja	kafɔnja
Jesus Christ	jɛzukristo	jezukristo

We can clearly observe tongue root position harmony in the loanwords above, although rounding harmony is absent.

4 Optimality and harmony

4.1 Background: Optimality Theory

Optimality Theory (Prince and Smolensky 1993) provides an excellent theoretical paradigm for the analysis of vowel harmony[6]. Where traditional generative phonology proposes an ordering of rules, Optimality Theory places constraints on the surface form of the output; it is assumed that

[6]OT is certainly not the only framework within which vowel harmony can be analyzed. In fact, Goad (1991) presents a very effective Feature Geometry analysis, of which Akinlabi's analysis (presented in section 4.3) is something of a direct descendant.

the correct ordering of constraints will always produce the correct output. Constraints are divided into two categories: faithfulness, which preserves lexical distinctions, and markedness, which discourages "undesirable" sets of features. In the remainder of this chapter I will present different Optimality Theory analyses of vowel harmony. For the sake of simplicity, my illustrations in this chapter will address basic instances of ATR harmony only; the next chapter will consist of evaluation and synthesis of the hypotheses for both tongue root and rounding harmony.

4.2 Agreement constraints and stem control

I will first address agreement constraints in OT, because they are somewhat more intuitive. Simply put, an agreement constraint requires that the surface form agrees in some feature. For Akan vowel harmony the relevant features are, obviously, [ATR] and [round]. This is the constraint favored by Bakovic (2000, 2001, 2003). In Bakovic's analysis, which I will term the stem control analysis, vowel harmony is an outward propagation of the harmonic feature.

Bakovic (2003) in fact uses Akan ATR harmony as an example of stem control, one which exhibits root-outward harmony in both directions.

(32) $[\, V_{pfx} \, [\, [\, \sqrt{} \, CV \,] \, V_{sfx} \,] \,]$

$\leftarrow\leftarrow\leftarrow \, [\alpha \, \text{ATR}] \, \rightarrow\rightarrow\rightarrow$

Bakovic proposes that harmony is clearly controlled by the stem, because affixation in Akan is bidirectional. Such behavior differs from rightward harmony, as in Tangale, or leftward harmony, as in Yoruba (another Kwa language). Tangale and Yoruba have rightward and leftward affixation, respectively. It is important to note, however, that terms such as "outward" and "leftward" are spatial metaphors. Stem-control harmony is not the same as pre-OT autosegmental analyses; rather than merely being a directionally assimilative process, stem control theory regards har-

mony as operating on different domains. This is an important distinction, because it allows for transparency and opacity of segments.

Bakovic assumes full specification, both of stems and of affixes. In the stem control analysis of vowel harmony, harmonic features propagate outwards from the stem. Harmony simply follows from markedness; even if affixes are specified with some alternate value, agreement "overwhelms" them.

Stem control relies on several OT constraints. The first is AGREE[ATR], a markedness constraint:

(33) AGREE[ATR] - Adjacent segments have the same value for [ATR].

Such a constraint is phonetically grounded in the fact that differing values of [ATR], by definition, require movement of the tongue root. AGREE[ATR] is violated if two vowels with no intervening vowels (intervening consonants are allowed) do not share a particular [ATR] value. The next two constraints are faithfulness:

(34) IO-IDENT[ATR] - Corresponding input and output segments have the same value for [ATR].

IO-IDENT[ATR] is a general-purpose faithfulness constraint. It is violated for each and every change in [ATR] value between input and output.

(35) SA-IDENT[ATR] - Corresponding stem and affixed form segments have the same value for [ATR].

SA-IDENT[ATR] is violated if and only if the values of [ATR] within a stem change when affixation takes place.

Using the example of Yoruba, another Kwa language in which the [-ATR] low vowel /a/ is opaque to harmony, Bakovic proposes a fourth constraint:

(36) *[+low, +ATR] - Segments may not be simultaneously [+low] and [+ATR].

With regards to Akan, *[+low, +ATR] is simply a ban on æ. The following constraint ranking, then, will ensure opacity of the vowel /a/:

(37) *[+low, +ATR], SA-IDENT[ATR] ≫ AGREE[ATR] ≫ IO-IDENT[ATR]

We can see the efficacy of the stem control analysis when we examine samples of Akan:

(38) o.be.tu.i 'he came and dug it'
ɔ.bɛ.tʊ.ɪ 'he came and threw it'

In the example of /obetui/, we see the [+ATR] feature propagating outwards from the root; in /ɔbɛtʊɪ/ we see [-ATR] propagating outwards. Bakovic's constraint ranking will accurately predict such a result. For the time being, let us assume that all affixes are underlyingly [-ATR], simply because we have no reason to assume either value.

(39)

/ɔ+bɛ+tu+ɪ/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
ɔbɛtuɪ			*!*	
ɔbɛtʊɪ		*!		
☞ obetui				***
obetʊi		*!	**	

(40)

	/ɔ+bɛ+tu+ɪ/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
	ɔbɛtuɪ		*!	**	*
☞	ɔbɛtʊɪ				
	obetui		*!		****
	obetʊi			*!*	***

Stem control will also accurately explain disharmonic words such as /o.bisa.ɪ/ 'he asked':

(41)

	/ɔ+bisa+ɪ/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
	obisai			**!	***
	obisæi	*!	*		***
	ɔbɪsaɪ		*!		*
	ɔbisai			**!*	**
☞	ɔbisaɪ			*	*

Although stem control adequately explains all of the data presented in Bakovic's paper (and other data), he does not present enough of a consistent pattern so as to necessarily justify the use of such an analysis. I will therefore evaluate this hypothesis considering the additional data I have presented in chapters 2 and 3.

4.3 Alignment constraints and licensing

4.3.1 Pure alignment

An alternative approach to stem control theory is that of alignment. Such an interpretation is presented by Kirchner (1993), who presents Turkish data (which is not actually particularly relevant to Akan, as it is such a different system). It is further developed by Pulleyblank (1996), who presents data from Yoruba, and Akinlabi (1997), who is modeling Kalabari. In contrast to agreement interpretations, alignment generates harmony by requiring the alignment of the harmonic feature with the edges of a particular domain. Note that Akinlabi's is basically an autosegmental

analysis. Akinlabi assumes underspecification for affixes; features spread outwards from the root, which has a single specification for ATR.

With regards to ATR harmony[7], Akinlabi defines these constraints as follows:

(42) ALIGN-[+A] RIGHT - The right edge of any [+ATR] specification is aligned with the right edge of a word.
ALIGN-[+A] LEFT - The left edge of any [+ATR] specification is aligned with the left edge of a word.

The ALIGN constraints are violated if [+ATR] fails to associate with the corresponding edge of a word. Akinlabi assumes that only one [+ATR] span can exist for any word; thus V[+ATR]V[-ATR]V[+ATR] is ungrammatical. Furthermore, the markedness constraint *[+low, +ATR] is also necessary in Akinlabi's analysis.

Three faithfulness constraints are needed as well:

(43) PARSE-FEAT - All underlying features are in the surface form of a morpheme.

(44) LEX-FEAT - All features present in output have a correspondent in lexical input.

(45) LEX-LINK - All featural associations are present in lexical input.

PARSE-FEAT is violated if and only if an ATR specification fails to manifest itself in output. LEX-FEAT is violated if an ATR specification appears without being present in input. LEX-LINK is violated if associations occur that are not fully specified in input.

[7]This is actually a specific case of a more general class of alignment constraints; see Akinlabi (1997) for more information.

Akinlabi argues for the following constraint ranking:

(46) *[+low, +ATR], PARSE-FEAT ≫ ALIGN-[+A] RIGHT, ALIGN-[+A] LEFT ≫ LEX-LINK

LEX-LINK will never do any work for us, so I will leave it out of my tableaux.

We can now consider the same examples presented above, considering /owu/ 'death' and /ɔwɔ/ 'snake':

(47)

	/OwU/, +ATR	*[+low, +ATR]	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT
☞	owu				
	ɔwu			*!	
	owʊ				*!
	ɔwʊ		*!		

(48)

	/OwO/, -ATR	*[+low, +ATR]	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT
	owo		*!		
	ɔwo			*!	
	owɔ				*!
☞	ɔwɔ				

Of course, we can account for disharmonic roots as well:

(49)

	/bIsA/, +ATR	*[+low, +ATR]	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT
☞	bisa			*	
	bɪsa		*!		
	bɪsæ	*!			
	bisæ	*!			

No articles in the literature actually attempt to apply the alignment analysis to Akan. Thus its success or failure with regards to Akan will be significant with regards to evaluating this approach.

4.4 Alignment and licensing

Piggott (1997) and Orie (2001) take the alignment analysis a step further, arguing that featural alignment must in fact be licensed by the prosodic head of a root. Orie's data comes from Yoruba, in which only regressive vowel harmony occurs; harmony does not spread forward from initial vowels, as evidenced by disharmonic roots. Thus, Orie maintains that the prosodic head of a root - its final syllable - licenses harmony. Such an analysis makes great sense for languages such as Yoruba in which only prefixation can occur, as it predicts disharmony in some roots and harmony in others. However, there is no real motivation for introducing such an explanation with regards to Akan; indeed, licensing requirement introduce such a level of complexity that it is reasonable to consider them unnecessary for this analysis.

5 Testing the hypotheses in different domains

I have shown in Chapter 4 that both established OT analyses of vowel harmony, namely stem control and alignment, are entirely sufficient for predicting simple harmonic and disharmonic patterns in Akan roots. This is due mostly to lexical faithfulness; the general result of the constraints in these theories is a preservation of the ATR specification contained in lexical input.

While both analyses accurately predict large portions of the attested Akan data, some definite variation can be observed in the effectiveness of each analysis. In this chapter, I will systematically each domain of Akan morphology. I will then apply each theory of harmony to the data. Note that exceptional cases are generally more interesting than well-behaved ones. Both theories easily explain harmony; their differences become apparent with regards to exceptional cases. It will become clear that alignment is greatly superior for explaining the disharmonies in dialects. In this

chapter the reasons for analyzing the three major dialects will become clear; the varying behavior of rounding harmony between dialects provides support to the idea that the Alignment theory is better-equipped to predict Akan forms.

5.1 Stem harmony

Harmony in Akan stems is, of course, a highly consistent pattern. If disharmony in stems was not so predictable, it would be tempting simply to treat those disharmonic forms as lexical idiosyncrasies. But instead of a lexical jumble, we can observe equally consistent patterns of disharmony; as discussed in 2.2, harmony in stems, when violated, is violated consistently by /a/ and /ɛ/ at the right edge of a word.

As I have shown above, both analyses are fully capable of predicting harmony in stems, and in fact most disharmonic forms can also be predicted. However, let us consider the less frequent disharmonic forms, those containing /ɛ/ and palatalized consonants (as discussed in 2.2):

(50) pink^{j}ɛ 'come close'
nʲinsɛn 'be pregnant'

Obviously, the stem-control constraint ranking will incorrectly predict this disharmonic form:

(51)

/pink^{j}ɛ/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
pink^{j}ɛ			*!	
☹☞ pɪnk^{j}ɛ				*
pink^{j}e				**!
pɪnk^{j}e			*!	

The alignment analysis also will be unsuccessful:

(52)

	/pInkʲE/, -ATR	*[+low, +ATR]	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT
	pinkʲɛ			*!	
☹☞	pɪnkʲɛ				
	pinkʲe		*!		
	pɪnkʲe				*!

Neither analysis has a good way of accounting for such disharmonic forms. It is tempting to blame the disharmony on the palatalized consonant; however, it does not matter if the /ɛ/ is immediately preceded or not. It is tempting to introduce a constraint to handle disharmonic /ɛ/. However, this is unjustified, where *[+low, +ATR] is in fact justified; recall that /a/ has no [+ATR] counterpart in Fante. /ɛ/ has an [+ATR] counterpart in all dialects, and it occurs frequently. It is somewhat suspect, therefore, to introduce a constraint specifically affecting /ɛ/. These forms are problematic for any theoretical analysis.

5.2 Regular affixes

5.2.1 Pronominal prefixes

Pronominal prefixes, unsurprisingly, are easily handled by both analyses. Consider /wu.di/ 'you eat'. The stem-control constraint ranking (still assuming that all affixes are underlyingly [-ATR]) makes an accurate prediction here:

(53)

	/wu-di/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
☞	wudi				*
	wudɪ		*!	*	**
	wʊdi			*!	
	wʊdɪ		*!	*	*

The alignment analysis is also successful:

(54)

/wU-dI/, +ATR	*[+low, +ATR]	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT
☞ wudi				
wudɪ			*!	*
wʊdi				*!
wʊdɪ		*!		

5.2.2 The perfect prefix

The perfect prefix consistently ignores harmony and creates a new [-ATR] span. Once again, both analyses are fully capable of handling this, thanks to *[+low, +ATR]. Consider /ɔ.a.tu/ 'he has dug it up'.

(55)

/ɔ-a-tu/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
☞ ɔatu			*	
oatu			**!	*
ɔatʊ		*!		*
oætu	*!			**
oætʊ	*!	*	*	***

The alignment analysis is also successful:

(56)

/O-A-tU/, +ATR	*[+low, +ATR]	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT
oatu			*	*!
☞ ɔatu				*
ɔatʊ		*!		
oætu	*!			
oætʊ	*!			*

5.3 Directional asymmetry

As noted in Chapter 2, the future, progressive, ingressive, and egressive prefixes all exhibit both tongue root and rounding harmony in Fante, but only tongue root harmony in Akuapem and

Asante. For the Twi dialects, this is a trivial case. Fante requires that we introduce a notion of rounding harmony. Consider /ɔ.bɔ.kʊ/ 'he comes and fight', as compared to /mi.be.dzi/ 'he comes and eats it'.

Suppose we add a constraint AGREE[round] to the stem-control ranking:

(57) *[+low, +ATR], SA-IDENT[ATR] ≫ AGREE[ATR], AGREE[round] ≫ IO-IDENT[ATR]

The former is now easily handled (ignoring *[+low, +ATR] and IO-IDENT[ATR] as both are irrelevant here), even if we assume that the ingressive is underlyingly the [-ATR, -round] /bɛ/:

(58)

/ɔ-bɛ-kʊ/	SA-IDENT[ATR]	AGREE[ATR]	AGREE[round]
oboku		*!	
oboku	*!		
☞ ɔbɔkʊ			
ɔbɔku	*!		
obeku		*!	
obeku	*!		
ɔbɛkʊ			*!
ɔbɛku	*!		

But if we consider a form such as /ɔ.kʊ.ɪ/ 'he fought', stem control fails:

(59)

/ɔ-kʊ-ɪ/	SA-IDENT[ATR]	AGREE[ATR]	AGREE[round]
okʊi		*!*	
okʊɪ		*!	
okʊu		*!*	
okʊʊ		*!	
ɔkʊi		*!	
ɔkʊɪ			*!
ɔkʊu		*!	
☹☞ ɔkʊʊ			

This problem will recur with the stem control analysis; in its pure form, it cannot account for directional asymmetry in vowel harmony. The alignment analysis, on the other hand, can make the proper prediction. Noting that rounding harmony only spreads leftward in Fante, let us try the following constraint ranking:

(60) *[+low, +ATR], PARSE-FEAT ≫ ALIGN-[+A] RIGHT, ALIGN-[+A] LEFT, ALIGN-[+round]LEFT ≫ LEX-LINK

Recall that Akinlabi's ALIGN constraints allow only one span for a particular feature in a particular word.

Such a ranking succeeds in predicting /ɔ.bɔ.kʊ/:

(61)

/ObV[mid]kU/, -ATR, +r	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT	ALIGN-[+r]LEFT
oboku		*!		
oboku	*!			
☞ ɔbɔku				
ɔbɔku			*!	
obeku		*!		
obeku	*!			
ɔbɛku				*!
ɔbɛku				*!

The ranking fails for /ɔ.kʊ.ɪ/ 'he fought', but it only fails in that it fails to select a winner (i.e. it does not select the wrong winner, like stem control):

(62)

/OkUV[high]/, -ATR, +r	PARSE-FEAT	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT	ALIGN-[+r]LEFT
okʊi		*!	*	
okʊɪ		*!		
okʊu		*!	*	
okʊʊ		*!		
ɔkʊi			*!	
ɔkʊɪ				
ɔkʊu			*!	
ɔkʊʊ				

We can salvage this analysis by adding one further constraint:

(63) *[+low, +ATR], PARSE-FEAT ≫ ALIGN-[+A] RIGHT, ALIGN-[+A] LEFT, ALIGN-[+round]LEFT ≫ ALIGN--[+round]RIGHT ≫ LEX-LINK

(64)

/OkUV[high]/, -ATR, +r	ALIGN-[+A] RIGHT	ALIGN-[+A] LEFT	ALIGN-[+r]LEFT	ALIGN-[+r]RIGHT
okʊi	*!	*		
okʊɪ	*!			
okʊu	*!	*		
okʊʊ	*!			
ɔkʊi		*!		
ɔkʊɪ				*!
ɔkʊu		*!		
ɔkʊʊ				

Note that Asante rounding harmony in suffixes can be predicted by a similar constraint ranking:

(65) *[+low, +ATR], PARSE-FEAT ≫ ALIGN-[+A] RIGHT, ALIGN-[+A] LEFT, ALIGN-[+round]RIGHT ≫ ALIGN-[+round]LEFT ≫ LEX-LINK

5.4 Exceptions

The remaining unexplained affixes in Akan are Akuapem progressive /rɪ/, and four nominal affixes that never harmonize: the "person" suffix /ni/, the diminutive /wa/, the personal plural /fɔ/, and the kinship plural /nʊm/. The Akuapem progressive is essentially unexplainable within OT. The other suffixes are problematic, but thankfully, the disharmonic suffixes can be generalized as consonant-initial noun suffixes (furthermore, /wa/ will in fact be covered by the constraint *[+low, +ATR]).

Note that the suffixation of /ni/ to /latɛ/ produces /læteni/. Stem control predicts this, if we assume the right underlying representation:

(66)

	/læte/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
	læte	*!			
	lætɛ	*!			*
	late			*!	*
☞	latɛ				**

(67)

	/læte - ni/	*[+low,+ATR]	SA-IDENT[ATR]	AGREE[ATR]	IO-IDENT[ATR]
☞	læteni	*			
	lætɛni	*		*!*	*
	lætenɪ	*		*!	*
	lætɛnɪ	*		*!	**
	lateni		*		*!
	latɛni		*	*!*	**
	latenɪ		*	*!	**
	latɛnɪ		*	*!	***

However, this surprising behavior only occurs because /ni/ assimilates the preceding vowel. /nʊm/ and /fɔ/ remain problematic in either theoretical paradigm.

5.5 Final comments on the OT analyses

While Alignment predicts disharmonies somewhat more accurately than Stem Control and Agreement, neither system is fully adequate for predicting all attested patterns in the language. I would argue that Alignment is generally a better theoretical paradigm for future work on Akan; although in its current state it cannot completely represent harmony, it has clear advantages with regards to the directional asymmetries associated with rounding harmony.

Conclusion

Akan vowel harmony, although full of seeming "exceptions", is in fact highly regular. It is entirely possible to formulate a schematic of when harmony will and will not apply, and such a schematic breaks down into a regular pattern. Disharmonic forms are well-attested in roots, but only with regards to the low vowel /a/ and a few instances of /ɛ/. In affixes, disharmonic forms only appear in consonant-initial nominal suffixes, affixes containing the frequently poorly-behaved /a/, and a single transparent prefix in Akuapem. Directional asymmetries in rounding harmony occur in Fante and Asante. Of the two OT analyses examined, Alignment works significantly better as a predictive model; Stem Control and Agreement fails to predict directional asymmetry. However, several irregularities exist which still cannot be explained by either model.

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