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PLACE-NAME LEXICALIZATION IN AKAN: ON THE SEGMENTAL AND PROSODIC PROCESSES AND CONSTRAINTS

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This paper examines the formation of three classes of partative-based place names in Akan within linear and non-linear phonology. Principally, the study aims to identify impermissible vowel-sequence cases in place-name lexicalization and the segmental and prosodic remedies available in Akan grammar for resolving them. Examples of categories of partative-based place-names under investigation are: (i) **kubaasi** consisting of **kube** 'coconut tree' and **asɪ** 'under'; (ii) **duasʊ** consisting of **dua** 'tree' and **(ɛ)sʊ** 'on top of (it)'; (iii) and **æsuom** made up of **æsuo** 'waters/rivers' and **(e)mu** 'within or among it'. The study reveals deletion, compensatory vowel lengthening, vowel and consonant assimilation, glide-onset formation as some of the processes deployed towards the resolution of ill-formed vowel-sequence cases in place-name lexicalization in Akan. It is observed that these processes are deployed towards preserving marked sonorous units over their least marked sonorous counterparts, contrastive units over predictable units.

Keywords: Akan, segment, prosody, vowel, sequence, lexicalization

1. Introduction

This paper provides a phonological analysis of three classes of partative-based place-name formation in Akan. Of great interest here are the segmental and prosodic processes, and the constraints for vowel-sequence resolution at the stem-stem boundary in this lexicalization process. The beauty of the current study lies in how Akan grammar regulates very intricate competing segmental/featural and prosodic demands in the formation of partative-based place-names. The demands of the phonotactics, the prosody and the need to sustain semantic salience are all crucial such that place-name lexicalization is a compromising endeavor from these quarters rather than any of them having it their way fully. The analysis is couched within rule-based (linear and non-linear) and constraint-based phonology.[1] Akan is a Niger-Congo (Kwa) language spoken in Ghana. In the traditional Akan socio-cultural setting, place-names are landmarks and symbols of community value, which community members must strive to sustain

[1] A reviewer questioned the need to employ all these theories in the current study and following are my reasons why they are necessary. A linear phonological account is meant to focus on (and therefore establish) strictly segmental/featural issues or processes involved in these categories of place-name lexicalization. The non-linear representation allows for syllable processes in the data to be discussed and defined. Constraints are the requirements for which reason output forms must be realized somehow. They are the reason linear and non-linear processes must apply. That is, there is the need to extend the analysis to these conditions for which reason observed linear and non-linear rules apply.

and enhance. That is, place-names are not arbitrary labels. The rest of the paper has been subdivided as follows: Section (2) provides the grammatical background of partative nouns, their distribution(s) and uses. Section (3) provides the phonological background for the analysis. Section (4) provides some of the relevant theoretical information for the present analysis, namely sonority, markedness and prosodic morphology theory. Section (5) is devoted to vowel sequences at the stem-stem boundary involving the low vowel /a/ as it relates to ***asɪ***-based place-names. Section (6) focuses on vowel sequences and other stem-stem boundary phenomena in the case of ***emu*** and ***ɛsʊ*** place names together. Section (7) offers a linear summary of the rules. Section (8) situates matters of constraint interaction within Optimality Theory to understand the nature of resolution of the competing demands on output forms from the phonotactics, prosody and the semantics. Section (9) provides a very brief conclusion.

2. On the grammar (i.e., morphology, syntax and semantics) of partative nouns in Akan

The focus here is to outline the structure of partative-based place-names. The following formal characteristics are noted of the place-name data under discussion. They are underlyingly possessive constructions with the basic phrase structure: /NP1$_{\text{possessor}}$ Ø NP2$_{\text{possessum}}$/, as it is basically the structure for possessive constructions in Akan as in: **Kofi**-$_{NP1}$ **anim**-$_{NP2}$ "Kofi's face", or "in front of Kofi". The overall head of the phrase above is (within) NP2 (i.e., **anim**) which is also the head (i.e., **anim**) in this case. The two NPs (i.e., NP1 and NP2) are held together in the possessive construction by a null-possessor (i.e., Ø). In other words, **Kofi** and **anim** do not need an overt possessive unit to join them into a possessive construction in Akan. In possessive constructions in Akan, the content or referent of NP2 is vague or indefinite for which reason NP1 is augmented before it (NP2) to make it definite. The possessive constructions in the present study that are lexicalized into place-names uniquely are headed by partative nouns (Ofori 2006a) (or relational nouns, according to Boadi 2010). I follow Ofori (2006a) in referring to these heads as partative nouns after the fact that these heads denote some part of, or some part in relation to, the NP that modifies them (i.e., NP1). That is, the referent of NP1 provides some (perceived) context (i.e., the physical, temporal, non-temporal, spatial context, etc.), and the partative noun, a point, some space or unit in relation to (i.e., possessive of, or definable by) the (perceived) context.

On the basis of syntactic distribution, Boadi (2010: 228) treats partative (i.e., relational) nouns as postpositional words. Note that these postpositional phrases are being treated in the present study as possessive constructions. Boadi cites the words in (1) below as the commonest postpositions (i.e., partative nouns) in Akan:

(1) Some postpositions (i.e., partative nouns) in Akan
"(a) **emu** 'inside, the interior'; (b) **ɛso** 'the top, surface'; (c) **aseɛ** 'the bottom part'; (d) **ɛho** 'the exterior'; (e) **ɛtoɔ** 'the rear'; (f) **ano** 'the mouth, nearer side'; (g) **akyire** 'the back, the rear, the farther side'; (h) **anim** 'the front, the facial, the face'; (i) **benkum** 'left(part)'; (j) **nifa** 'right(part)'; and also (k) **anaafoɔ** 'direction towards which a river flows, legs' end' and (l) **atifi** 'direction from which a river flows'." He observes that "[l]ike all other nouns postpositions have a prefix, which is phonologically a vowel, a nasal consonant or zero. The vowel is deleted in given contexts, possibly by a phonological rule."

Positions in the last two sentences – such as partative nouns bearing prefixes and these affixes being often deleted phonologically – are important in our formal account of place-name lexicalization in the current study.

While the following may not be relevant to the current study, it is necessary to provide

Boadi's complete account of the behavior of these unique nouns in Akan grammar. Boadi (2010: 217) identifies two functional uses of partative (i.e., relational) nouns as in possessive constructions as: alienable and inalienable. He observes that partative nouns in their alienable uses usually take a suffix whereas their inalienable uses are without such. For example, the Akan word for 'buttock' is **ɛto-ɔ** (alienable), but **ɛto** (inalienable); i.e., alienable (**ɛtoɔ**, as in: **Kofi toɔ** 'Kofi's buttock'-some buttock which Kofi owns*) when the word i*s not an integral and permanent part of the associative phrase (i.e., the NP1 and null-possessor combined); inalienable (**ɛto**, as in: **Kofi to** 'Kofi's buttock') when the entity is an inseparable part of the referent. To explain this further, I will say that in the first usage, the 'buttock' is owned, non-inherently by Kofi (**Kofi toɔ,** i.e., alienable), as opposed to it being owned, inherently, by Kofi (**Kofi to**, i.e., inalienable**).**

A common semantic feature of the two uses is that the unit denoted by the partative noun in both uses must be among the (perceived) scope of things associated with the referent of the associative phrase (in the above example, Kofi) and all that could possibly be attributed to – or associated with - him, either inherently (i.e., inalienably) or non-inherently (i.e., alienably). In other words, the associative phrase and partative noun relation is inalienable when the partative noun denotes a non-detachable constituent of the referent of the associative phrase, but alienable whereby the referent of the partative noun is mainly definable by, but not inherently associated with, the (perceived) scope of the referent of the associative phrase. That is, in the two uses, a referent of the partative noun only becomes definite or specifiable on the basis of the referent of the associative phrase and of the associative/possessive relation the two nouns are put into, either implicitly or explicitly.

While Boadi (2010) focuses on the syntactic uses of partative nouns with their semantic functions, the current study is concerned about the compounding (i.e., lexicalization) of partative nouns (PN) with their associative phrase modifiers (AsP) in Akan as the structures in Table (1) below illustrate:

Table 1. ***Distributions of partative nouns in the syntax and the morphology***

Input		Output (compounded/lexicalized)
X	Y	Z = [XY]
AsP (→ NP+As)	Partative Noun (PN)	[AsP+PN]
kwaeɛ + Null "forest"	emu "interior"	kwaeɛm [kʷaɪjem] "the setting of the forest"

In Table (1), the noun phrase, **kwaeɛ mu** "literally: forest's interior" (or the sight of the forest) consisting of an associative phrase *(i.e., AsP → **kwaeɛ (NP)** + a zero possessive morpheme (Null))* and an NP headed by **(e)mu** (i.e., a partative noun) combine into the place-name **kwaeɛm** [kʷáí!jém̀] (Tone: HH**!H**H) "forest-sight". That is, the phonological component plays a vital role in what this input finally becomes lexically. Therefore, there is the need for some phonological background as pursued in section (3).[2] Note that the current study is only devoted to the formation of partative-based place-names involving the partative nouns, **ase(ɛ) /asɪ/** "bottom", **emu /ɛmu/** "inside, the interior", and **ɛso /ɛsʊ/** "top-part, surface-part".

[2] In a stem noun with the morpheme-sequence, Prefix-Root, the prefix carries a low tone and the root a high tone. Compounding creates a high-tone downstep where the low-tone bearing prefix is V_2 and deletes without its low tone. This floating low-tone is what is responsible for high-tone downstepping (i.e., !H) – a slight lowering of the high-tone immediately after the floating low-tone of the deleted-V_2.

3. A brief phonological background on Akan

The discussion that follows focuses on sounds (vowels and some consonants), vowel sequences and some consonants of Akan. The tables below Table (2) – i.e., Table (3) and (5) – showcase vowels and consonants of Akan respectively.

Table 2. ***Akan vowel sounds***

	Levels of representat ion	±HIGH /±LOW	±ROUND				
			-round (front)		*-round (central)*	*+round (back)*	
					±ATR		
			-atr	*-atr*	*-atr*	*+atr*	*-atr*
		(i)	*(ii)*	*(iii)*	*(iv)*	*(v)*	*(vi)*
a.	Orth.	+high(-low)	**<i>**	**<e>**		**<u>**	**<o>**
	Phonology	+high(-low)	/**i**/	/**ɪ**/ *(→[i])*		/**u**/	/**ʊ**/ *(→[u])*
	Phonetic	+high(-low)	**[i]**	**[ɪ]** *(~[i])*		**[u]**	**[ʊ]** *(~[u])*
b.	Orth.	-high -low	**<e>**	**<ɛ>**		**<o>**	**<ɔ>**
	Phonology	-high -low	/**e**/	/**ɛ**/ *(→[e])*		/**o**/	/**ɔ**/ *(→[o])*
	Phonetic	-high -low	**[e]**	**[ɛ]** *(~[e])*		**[o]**	**[ɔ]** *(~[o])*
c.	Orth.	+low(-high)			**<a>**		
	Phonology	+low(-high)			/**a**/ *(→ [æ] ~ [e])*		
	Phonetic	+low(-high)			**[a]** *(~ [æ] ~ [e])*		

Orthographic forms of vowels appear in "<>" with their phonological/phonemic and phonetic representations beneath them in the same column – with phonemic equivalents in "//" (oblique strokes or slashes), and phonetic realization(s) in "[]" (square bracket). A feature in a bracket "()" may not be used with a feature before it, which is outside the bracket, to describe a vowel simultaneously. For example, a vowel will never be specified with the features +high and -low simultaneously. [-high] and [-low] can be used simultaneously to describe a vowel and explains why none of the two features is in a bracket. The feature mid (i.e., [+mid]) may sometimes be used to stand for the features, [-high] and [-low], together. The phonemic vowels /ɪ, ʊ, ɛ, ɔ, a/ are phonologically/underlyingly [-ATR] vowels; that is, associated with their production is the retraction (i.e., non-advancement) of the tongue root. These vowels often undergo [+ATR] harmony to [i, u, e, o, æ] respectively. It needs to be noted that the feature [+ATR] is underlying for four vowels for which reason those vowels appear in slashes in the table, namely /i, u, e, o/ and phonetically are realized as [i, u, e, o] – i.e., as "exact" copies of their underlying forms respectively. So, it is not every advanced non-low vowel which occurs in some Akan speech (i.e., [i, u, e, o]) that might have been derived through [+ATR] harmony. Advanced tongue root ([+ATR]) harmony in Akan demands that a retracted (or an unadvanced) vowel (i.e., /ɪ, ʊ, ɛ, ɔ, a/, [-ATR]) harmonizes with an abutting vowel in its underlying [+ATR] feature. Changes from [-ATR] to [+ATR] due to the [+ATR] rule have been indicated in the table with the representations: "(→ […])" and (~ […]) placed immediately after the [-ATR] vowels concerned. The resultant advanced vowel ([+ATR]) is what occupies the square bracket. The [-low]/[+low] feature distinction will be invoked when the rest of the vowels ([-low], /i, ɪ, u, ʊ, e, ɛ, o, ɔ/) are found to pattern against the low vowel, /a/. In situations where the low vowel patterns with the mid vowels in their phonological behavior, the feature [-high] becomes a class label so to differentiate them (i.e., the low and mid vowels put together: /a, e, ɛ, o, ɔ/) from sounds belonging to the high-category which may not behave similarly. Where a three-term label will suffice in a vowel's description and identification, the following feature-sequence order will be observed, namely the vowel's height (i.e., [+high], or [-high -low], or [+low]), its lip posture (i.e., [-round] or [+round]), to be ended by its specification of tongue-root advancement or non-advancement (i.e., either [-ATR] or [+ATR]).

Table 3. ***Feature matrix for vowel in Akan***

Phonemes	/i/	/u/	/ɪ/	/ʊ/	/e/	/o/	/ɛ/	/ɔ/	/a/
High	+	+	+	+	-	-	-	-	-
Low	-	-	-	-	-	-	-	-	+
Rd/Bk/Lab	-	+	-	+	-	+	-	+	-
ATR	+	+	-	-	+	+	-	-	-

The table of vowel sequences below was taken from Dolphyne (1988) to provide us with some relevant background information on vowel sequence constraints in Akan. This is her account of the permissible vowel sequences within words in Akan and will give us some hint on the rationale for certain vowel sequence resolutions between morphemes in place-names.

Table 4. ***Vowel sequence in Akan*** *(Dolphyne 1988:9)*

	i	ɪ	e	ɛ	a	ɔ	o	ʊ	u
i	ii		ie	iɛ /ia/	ia		io		
ɪ		ɪɪ		ɪɛ	ɪa				
e	ei		ee						
ɛ		ɛɪ		ɛɛ					
a		aɪ			aa				
ɔ		ɔɪ				ɔɔ			
o	oi						oo		
ʊ		ʊɪ		ʊɛ	ʊa	ʊɔ		ʊʊ	
u	ui		ue		ua		uo		uu

In the table below are some Akan consonants. I have restricted the list to the ones needed for the present study.

Table 5. ***Aspects of Akan (Twi) consonants***

	r	n	m	N	w	f	s	ɕ	h	p	b	t	d	k	g	tɕ	dʑ	tɕɥ	dʑɥ	j
SON	+	+	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ANT	+	+	+	-	-	+	+	-	-	+	+	+	+	-	-	-	-	-	-	-
LAB	-	-	+	-	+	+	-	-	-	+	+	-	-	-	-	-	-	+	+	-
COR	+	+	-	-	-	-	+	+	-	-	-	+	+	-	-	+	+	+	+	+
DOR	-	-	-	+	+	-	-	-	-	-	-	-	-	+	+	-	-	-	-	-
NAS	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

The feature labels, labial and coronal can be extended to back/round and front/non-round vowels in Akan respectively.

4. Theory and positions

Two of the essential claims of the theory of prosodic morphology are very relevant in the account of the formation of partative-based place-names in Akan. The two salient principles are: (a) Prosodic Morphology Hypothesis and (b) Template Satisfaction Condition (but not the third, Prosodic Circumscription).

(2) *Some principles of prosodic morphology*

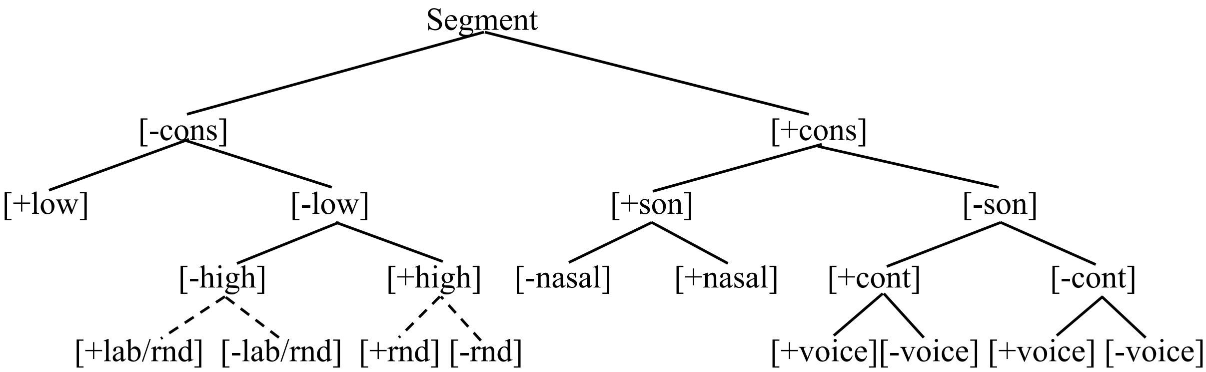
(a) Templates are defined in terms of the authentic units of prosody: mora syllable, foot (F), prosodic word (PrWd).

(b) Satisfaction of templatic constraints is obligatory and is determined by the principles of prosody, both universal and language-specific.

An examination of output forms of partative-based place-names reveals a minimum syllable requirement of four on place-names. For this reason, the assignment of segments to syllable slots is carefully pursued, to avoid anything less than the four-syllable requirement on partative-based place-names, guided by principles (i.e., constraints) that basically work to achieve segmental contrast and phonotactic well-formedness simultaneously.

The forms that serve as inputs in the formation of partative-based place-names are independent stem words. The partative noun subpart of the two forms that join in place-name formation always comes with a nominal prefix. As a result, a vowel sequence always emerges at the stem-stem boundary of which there is often the need to respect certain phonotactic requirements (i.e., constraints) on vowel sequence/hiatus – i.e., the need for hiatus resolution. Claims of the sonority scale and of the markedness theory are significant in such hiatus resolutions. Sonority and markedness principles interact with constraints that act to preserve lexical contrast in deriving more lexically/contrastively- and structurally/phonotactically-optimal place-name outputs. Sonority is "[t]he overall loudness of a sound, relative to others of the same pitch, stress, and duration" (Crystal 1992). It is believed in phonological theory that "… in each utterance, there are as many syllables as there are clear peaks of sonority" (Blevins 1995). Blevins posits what she calls a working universal sonority scale, as given below, on which the segmental contents of syllables of languages are said to be based.

(3) ***Blevins' working universal sonority scale***



The sonority scale aids both in the conceptualization and concretization of the syllable and syllabification – i.e., in understanding which group of segments may co-occur within the syllable of a language. Such segment combinatorial possibilities are captured through the sonority sequencing principle (SSP) which denotes segments at the syllable margins or peripheries (i.e., onset and coda) as falling in sonority from the nucleus. The scale is equally significant in the construction of syllable sequence – that is, here, the sonority scale motivates sound sequencing between abutting syllables (i.e., as in the syllable contact law). It is in the above means that sonority as a phonological concept is significant in the current study. The part of the sonority scale, namely: [+low] >> [-high] >> [+high] equally depicts vowel markedness, from marked (i.e., high in sonority) to unmarked (i.e., less sonorous). Below is a summarized proposal of vowel sonority and markedness preference order for Akan:

Table 6. ***Segments in column (I) with their sonority and markedness information in column (II) and (III) respectively***

Column (I): Segment/Feature	Column (II): Sonority designation	Column (III): Markedness designation
+low	High >>	High >>
-high (-low)	Middle >>	Middle >>
+high	Less	Less (i.e., unmarked)

In the formation of place-names, an impermissible vowel sequence is always resolved in favor of an item higher on the hierarchy – i.e., hiatus resolution is preservation of the more sonorous and marked of abutting vowels. This entails that the less sonorous and marked of a vowel sequence is always the target for any formal alteration in situations of vowel-sequence ill-formedness. Abundant in grammar are the phonotactic constraints that a language may implement to obviate perceived vowel-sequence ill-formedness, for which reason, sometimes, even a deviant output may be more preferred (i.e., becomes optimal). The pro-phonotactic well-formedness constraints that are crucial to vowel-sequence ill-formedness resolution in the current study have been outlined and explained in section (8).

Three classes of partative-based place-names have been selected for description and rule-based analysis in sections five and six, with section seven being the summary of linear rules in sections five and six. The three classes are, namely ***asɪ***-based place names (in section five), ***emu***-based place-names and ***ɛsʊ***-based place names (in section six).

5. Phonological processes associated with the formation of asɪ-based place-names

In the data below is a sequence of two low vowels, namely a stem's final low-vowel and the following stem's initial low-vowel. There are basically four output possibilities here, one of which is preferred – which is (ii) in each case.

(4) *Data with /aa/ sequence at the stem-stem boundary*

	Place-name input	Place-name Output	Orthography	
a.	**oɲ(ɪ)ankʊma-asɪ** "the onyankoma plant's-underpart"	(i) ***ɲankʊmØ-Øsɪ** (ii) **ɲankʊma-Øsɪ** (iii) ***ɲankʊmØ-asɪ** (iv) ***ɲankʊma-asɪ**	**Nyankomase**	"the underneath/underpart of the onyankoma plant"
b.	**ɔdɔmɪna-asɪ** "the ɔdɔmɪna plant's-underpart"	(i) ***dɔmɪnØ-Øsɪ** (ii) **dɔmɪna-Øsɪ** (iii) ***dɔmɪnØ-asɪ** (iv) ***dɔmɪna-asɪ**	**Dɔmenase**	"the underneath/underpart of the ɔdɔmena plant"
c.	**ankaa-asɪ** "the ankaa/citrus plant's-underpart"	(i) ***ankaØ-Øsɪ** (ii) **ankaa-Øsɪ** (iii) ***ankaØ-asɪ** (iv) ***ankaa-asɪ**	**Ankaase**	"the underneath/ underpart of the ankaa/citrus.plant"

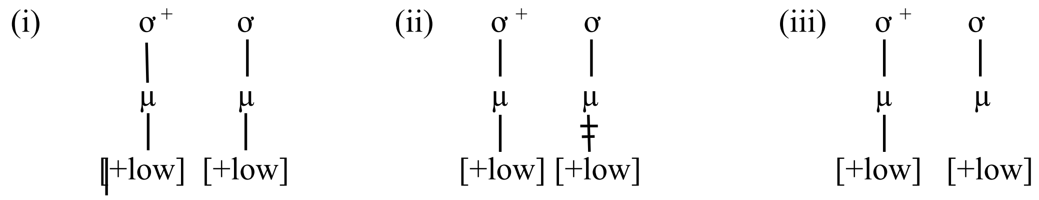
Following is how output possibilities, from (i) to (iv), of each input are different: output forms in (i) have their low-low vowel sequence deleted completely; in (ii), it is the second of the two low vowels that is deleted (the first low vowel is retained) and these are the preferred output forms; in (iii) is the reverse of (ii), the first low vowel rather deletes; in (iv), both low vowels are retained and these outputs are ungrammatical, just as (i) and (iii) are, in the language. Below are linear and non-linear generative representations on low-low vowel sequence resolution at the stem-stem boundary in place-name formation. Superscript "$^{+}$", as used below, demarcates meaningful units, namely morphemes, stems, etc.

(5) *Linear representation*
(a) Abstract templatic representation: **V → Ø /V^{+}__**
(b) A more concrete, segmental representation: **/a/ → Ø / a^{+}__**
(c) A more concrete, featural representation: **[+low] → Ø / [+low]$^{+}$__**

(6) *Non-linear representation*
(a) *With a V-template*:

$$\text{(i)}\ \begin{array}{ccc} [+\text{low}]^{+} & & [+\text{low}] \\ | & & | \\ V_1 & & V_2 \end{array} \rightarrow \text{(ii)}\ \begin{array}{ccc} [+\text{low}]^{+} & & [+\text{low}] \\ | & & \ddagger \\ V_1 & & V_2 \end{array} \rightarrow \text{(iii)}\ \begin{array}{cc} [+\text{low}]^{+} & \\ | & \\ V_1 & V_2 \end{array}$$

(b) With a prosodic template (σ "syllable"; μ "mora", used to indicate the weight of a syllable): (b-i) represents the input sequence; (b-ii) could be interpreted as either feature or prosodic delinking (i.e., termination of association) hence the lack of association (line) in (b-iii). Prosodic and featural properties exist, but are unpronounced due to lack of association.



Note that, in a preferred output, an initial vowel of the first stem-word is deleted when it is either [o] or [ɔ] (i.e., a non-low vowel as in (4a-ii) and (4b-ii)), but is retained when it is /a/, the low vowel (as in (4c-ii)). Below in (7) is a linear representation of stem initial [ɔ] and [o] deletion.[3]

(7) *Linear representations of initial-stem vowel deletion*
Abstract V-template representation: **V → Ø / #__+**
Concrete, segmental representation: **/ɔ, o/ → Ø / #__+**
Concrete, Featural representation: **[-low] → Ø / #__+**

It is not yet clear what the main motivations are for vowel deletion cases as illustrated above. Below in (8) is another /aa/ stem-boundary scenario with a slightly different outcome.

(8) $a^{+}a$ sequence

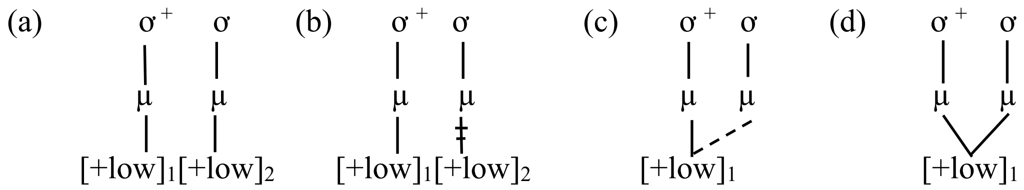
Place-name input	**Place-name Output**	**Orthography**	
odʑama-asɪ "the ogyama plant's underneath"	(i) ***dʑamØ-Øsɪ** (ii) ***dʑama-Øsɪ** (iii) ***dʑamØ-asɪ** (iv) ***dʑama-asɪ** (v) **dʑama:sɪ**	**Gyamaase**	"the underneath of the ogyama plant"

Here, the preferred output is (8-v) **dʑama:sɪ** with a doubly-associated low vowel (i.e., represented here as a long vowel). The rule in (7) applies here also in deleting the initial [-low] (i.e., [o]) of the initial stem. The rule representations in (5/6), partly repeated in (9a/b), hold here also in deleting the second of the two low vowels. What is different in the preferred output this time is that the first low vowel lengthens to make up for the deletion of the second low vowel. In other words, the first low vowel becomes associated with – i.e., becomes the nucleus of – two contiguous syllables as opposed to just one of them in the preferred output (as in 9d) for this particular input. The non-linear representation in (9c) illustrates vowel lengthening, and (9d) is the resultant surface/phonetic realization.[4]

(9) [+low] lengthening

[3] The [o] and [ɔ] are different for allophonic reasons – [+ATR] harmony accounts for their surface difference. The prefix is underlyingly {ɔ-} (and phonologically /ɔ/, a phoneme, [-ATR]) which gets realized as [o] (i.e., [+ATR] due to the need for a [-ATR] vowel to change to [+ATR] in harmony with a succeeding vowel (i.e., the [+ATR] harmony rule in Akan applies here). The rule as in (7) is a cover for non-low vowel deletion as it is often the case in Akan.

[4] An anonymous reviewer drew my attention to the need to mention tone here and I think that is a good idea. Here, both V_1 and V_2 are filled by a low vowel and tone serves as the evidence of V_2 deletion. V_2 bearing a low tone deletes for which reason a HLH tone-sequence comes to be realized as HH (i.e., the first high tone belonging to V_1 and the following high tone belonging to the initial syllable of the root morpheme that V_2 (with a low tone) is its prefix)).



At the moment, it is not clear why a_2 deletion in (8) must be compensated for through a_1 lengthening, but the same a_2-deletion must occur in (4) without the lengthening of a_1 to compensate for it. This quest borders on motivation and it will be addressed aptly with the unfolding of facts about the place-name data in consideration here.

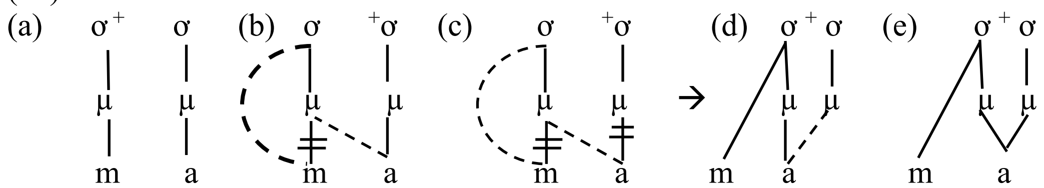
It has become necessary to indicate syllable boundary (here, with a dot) in (10). Following are interpretations of output forms as given in column two of (10).

(10)

Place-name Input	**Place-name Output**	**Orthography**	
	(a) ***ku.m.sɪ**	**Kumase**	"the underneath of
kum-asɪ	(b) ***ku.ma.sɪ**	**(*Kumasi)**	the kum plant"
"the kum plant's	(c) ***ku.m.<u>a.</u>sɪ**		
underneath"	(d) **ku.ma.<u>a.</u>sɪ**		

In (10a), **asɪ** "underneath" loses **/a/** to derive the intermediate output as in (10a). In (10b), **/a/** of **asɪ** is retained but resyllabified into the preceding syllable as its nucleus. This means that **/m/** loses its nuclear status to **/a/** possibly for the reason that, in Akan grammar, vowels are more preferred as nuclei over consonants. Consonants are more preferred as onsets, hence /m/ relinquishing its nuclear role, as plotted in (11b/c). In the end, **/m/** becomes an onset with its own syllable with the low vowel as its nucleus as plotted in (11d).

(11)



(b) Regressive Vowel doubling & Consonant resyllabified

(c) Vowel delinking; consonant resyllabified

(d) Vowel resyllabification & progressive Vowel doubling

= ku<u>**maa**</u>sɪ

(10a) does not emerge as the preferred output just because of the impermissible consonant sequence ms, even though the two belong to different, adjacent syllables. The form as in (10c) fails as the preferred output on count of the impermissible syllable-sequence C.V. In (10b), **/a/** of **asɪ** gets resyllabified into /m/ – that is, avoiding the impermissible C.V syllable-sequence, and yet it is dispreferred. (10d) **ku.ma.a.sɪ** has a syllable more than (10b) and it is considered more grammatical. (11b) and (11c) are alternative explanations of how /m/ becomes an onset with /a/ as its nucleus. It is either /a/ doubling regressively to delink /m/ (as in 11b), or /a/ becoming delinked first from its syllable after which it becomes reassociated regressively to the same nuclear-slot as /m/ and by so doing causing /m/ to be reassociated as onset of its own syllable as in (11c). Vowel doubling with the analysis in (11c) is progressive rather than regressive as illustrated in (11d) – i.e., with /a/ lengthening to save its underlying syllable after it has been resyllabified into /m/. In (11e) is the final output for both (11b) and (11c/11d), with /a/ having become doubly-associated in adjacent syllables to derive **ku.ma.a.sɪ**. I would prefer the latter account to the former for reasons given in footnote 6.[5] Now, on the preference of (10d) over (10b), if we resort to syllable counting, (10d) has four syllables as opposed to three in (10b). If syllable quantity has a role to play in this, it is not yet clear how the condition must be formulated. Therefore, we would focus on examining more of the data to see the kind of prosodic conclusion(s) to which, if any, the facts will rightly lead us.

In (12), (12b) /a/ becomes resyllabified into the preceding syllable without it becoming doubled as observed in (10d) and illustrated in (11). That is, the outcome that is preferred here totally contradicts our choice of the preferred candidate in (10), which is (10d). That is, here, (12d) with the /a/ doubling does not emerge as the preferred output.

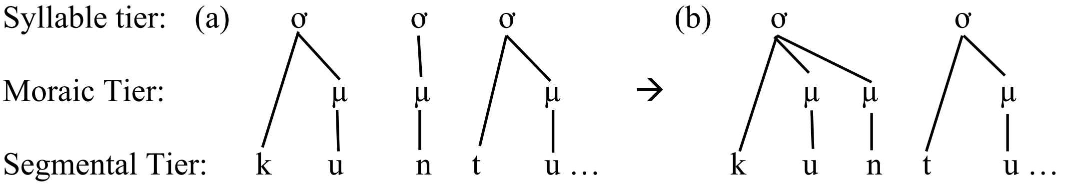
(12)

Place-name input	Place-name Output	Orthography	
kun.tu.n-asɪ “the kuntun plant’s underneath”	(a) ***kun.tu.n.sɪ** (b) (i) **kun.tu.na.sɪ** (or ? (ii) **ku.n.tu.na.sɪ)** (c) ***kun.tu.n.a.sɪ** (d) ***kun.tu.na.a.sɪ**	**Kuntunase**	“the underneath of the kuntun plant”

The challenge here is whether there is the need to posit a bimoraic monosyllable in the current study (i.e., following Ofori 2006b: 66) and on that basis consider (12b-i) as consisting of four syllables as opposed to five, as in (12b-ii). There is not a clear break between **[ku]** and **[n]** in the pronunciation of this place name such that a bimoraic monosyllable analysis of **[kun]** is in order; [n] basically exists to provide nasality to /u/. If we choose this heavy-monosyllable account (i.e., 12b-i) over (12b-ii) which suggests a light-syllable, then a prosodic pattern of four syllables is gradually emerging as the requirement for the formation of partative-based place names; possibly, a minimum requirement of four syllables on the place-names in consideration in the current study. In (13) below is a non-linear representation of bimoraicity in monosyllables. We limit its application here to the $(C)_1VC_2$ structure in which C_2 is a homorganic nasal and for that reason is followed by a consonant (in the above instance by /t/). My position is that bimoraicity in monosyllables in the current study are derived (i.e., an instance of formal reduction strictly on the syllable-tier, but not on the moraic and segmental tiers). /n/ (i.e., nasal) retention with syllable reduction is necessary to preserve contrast, as kutunası (without the homorganic n) is also grammatical in Akan and would change the meaning from “beneath the kuntun plant” to “beneath the pot”, that is, should homorganic /n/ be deleted.

[5] A reviewer raised the question on why the tone is H-LH but emerges as HHH. It is possible that /a/ loses it low tone as it becomes delinked and resyllabified into the preceding syllable which has a high tone. The fact that it becomes resyllabified with /m/ which bears a high is possibly responsible for its low tone loss, but its syllable is restored with progressive doubling of both /a/ and the preceding high tone to restore what has become a floating syllable.

(13) Syllable reduction: formation of a bimoraic monosyllable



= kun.tu.na.sɪ

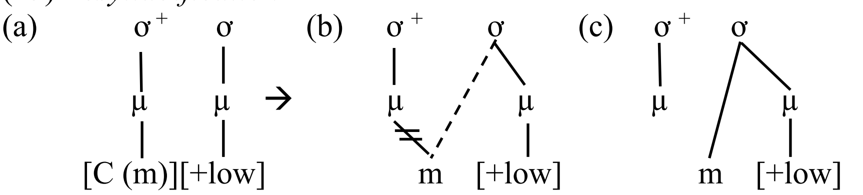
The preferred output in (14) is (14b) **o.du.ma.sɪ**. Here, even though the prefix is [-low] (i.e., **[o-]**), it is never deleted as rules in (7) would predict. The non-deletion is due to the fact that **[o]** is contrastive in the word **odum** "name of plant" Therefore, its deletion comes at a cost for which reason the grammar disallows it. That is, **odum** is a plant; the loss of **[o]** creates the word, **dum** "to put off; turn off, fire", and **dumasɪ** or **dumaasɪ** would mean "the putting out of a fire beneath something".

(14)

Place-name input	Place-name Output	Orthography	
o.du.m-asɪ "the odum plant's underneath"	(a) ***o.du.m.sɪ** (b) **o.du.ma.sɪ** (c) ***o.du.m.a.sɪ** (d) ***o.du.ma.a.sɪ**	**Odumase**	"the underneath of the odum plant"

The fact that **[o-]** is lexically-significant underlies its resistance to deletion. For this reason, there are five underlying syllables (i.e., **o$_1$.du$_2$.m$_3$.a$_4$.sɪ$_5$**) as opposed to the four-syllables required in production. Regressive /a/ lengthening, therefore, cannot become the mechanism by which the impermissible C.V syllable sequence must be disallowed since that process will not in any way cut down on the number of syllables. What we need is a mechanism that would help to achieve two prosodic requirements simultaneously – namely, the avoidance of the impermissible C.V syllable sequence and the requirement for four syllables on the surface (i.e., in production). These two prosodic requirements are achieved, in this context, by a process that merge the syllabic-C and the syllabic-V into a single syllable, thus, reducing the total number of syllables by one. The deletion of either /m/ or /a/ is not an option here. Deleting /m/ will affect the basic meaning of the root-word it belongs in; and an /a/ deletion will derive the consonant cluster, *ms, which must be avoided at all cost. In Akan grammar, /m/ as a consonant is better of as an onset than as a nucleus (especially word-medially), and this requirement is what underlies the merger that resolves the two prosodic requirements simultaneously. Consequently, /m/ relinquishes its nuclear association/role at the root-level, which is marked, for an onset association/role at the stem-level, unmarked. That is, it is delinked as a nucleus in one domain and becomes reassociated as an onset of the following syllable of an emergent domain by reason of this preference condition, as illustrated in (15) below.

(15) *Resyllabification*



o.du.m.a.sɪ → */m/-delinking as nucleus* **o.du.σ̱.ma.sɪ** → = **o.du.ma.sɪ**
[m] reassociation as onset *(empty σ erasure)*

The retention of /a/ (an affixal vowel) here is necessitated by prosodic and phonotactic/segmental well-formedness requirements as expressed immediately above. The delinking and reassociation of /m/ render its canonical syllable phonetically defective and, in this instance, defunct, as shown in (15c); and the minimum-syllable requirement of four is met (i.e., **o$_1$.du$_2$.ma$_3$.sɪ$_4$**).

The data in (16) is similar to those in (4) in possessing the /aa/ vowel sequence at the stem-stem boundary. In both data, the second /a/ is what deletes in a preferred output. Therefore, the output in (16) is (16b). There are two forms in consideration in (16b), namely (16b-i) and (16b-ii). (16b-i) has more segments and therefore more syllables than (16b-ii) – five syllables as against four syllables respectively. The initial /ɪa/ vowel sequence in (16b-i) has been reduced to [a] – with [a] emerging as the new nucleus of the first syllable of the word in (16b-ii) as opposed to [ɪ] in (16b-i) and, then followed by [a] in a separate syllable.

(16)

Place-name input	Place-name Output	Orthography	
tɕɥɪapɪa-asɪ “the tweapea plant’s underneath/shade”	(a) ***tɕɥɪ.a.pɪ.Ø-Ø.sɪ** (b) (i) ***tɕɥɪ.a.pɪ.a-Ø.sɪ** (ii) **tɕɥa.pɪ.a-Øsɪ** (c) ***tɕɥɪ.a.pɪ.Ø-a.sɪ** (d) **tɕɥɪ.a.pɪ.a-a.sɪ**	Tweapease	“the underneath or at the shade of the tweapea plant”

(16b-ii) is the preferred output of (16). At issue is why it is the initial /ɪ/ after [tɕɥ] (the labio-palatalized affricate), but not the second /ɪ/ after /p/ that must delete in order to derive the four-syllable output; or even why it is /ɪ/ (a high vowel), but not one of the remaining low vowels that must delete in this case. My initial understanding of the /ɪ/ after tɕɥ being deleted is the fact of it being predictable between tɕɥ and /a/ over the second /ɪ/ which occurs between /p/ and /a/ (i.e., $V_{COR} \rightarrow \varnothing$ / $C_{[DEL,\ CORONALIZED]}$ / [__]$_{\sigma}$.[+LOW]$_{\sigma}$…); the term “delayed” is used in reference to affricates in Akan which are generally back consonants which have undergone coronalization/palatalization.

Following are the contextual facts that make the /ɪ/ which occurs between [tɕɥ] and [a] highly predictable and ideal for deletion. tɕɥ is underlyingly a back consonant (i.e., k^w) that has been palatalized/coronalized before a front vowel. With /a/ as the nucleus of the preferred output form, the deleted front vowel is predictably a high front one (i.e., as either [i] or [ɪ]), because the remaining front vowels which are [-low] (i.e., e, ɛ) do not appear in a vowel sequence with /a/ (i.e., the *ea and *ɛa vowel sequences are not allowed in Akan grammar). That is, non-contrastive/predictable units are targeted for deletion to derive the minimum-required syllable-size over contrastive/non-predictable units. Markedness, sonority and the fact that a segment is non-contrastive/predictable all point to the high vowel as the unit that can be deleted over either a low vowel, or a mid-vowel. In terms of markedness, the high vowel is the most unmarked. In terms of sonority, the high vowel is the least sonorous; and in terms of contrastive usage and predictability in the current data, it is the non-contrastive and predictable segment. The observation that, in Akan grammar, non-contrastive (and predictable) units are often what are targeted for deletion can successfully be extended to explain why, in a sequence of /$a_1{}^+a_2$/ at the stem-stem boundary, it is always /a_2/ which is targeted for deletion. The /a_1/ forms part of the root whereas /a_2/ functions as the affix. In Akan grammar, a vocalic affix is often deleted over a root vowel for the fact that it is the root-vowel which is lexically significant, the vocalic affix is not. The need to sustain lexical contrast is what causes /a_2/ to delete over /a_1/ at the stem-stem boundary.

In (17 and 18), at the stem-stem boundary, is the vowel sequence type, /e^+a/, both of which are non-high (i.e., [-high][-high]) just like the /a^+a/ vowel sequence as discussed above. More specifically, /e/ is mid, unrounded and advanced and a root-vowel; /a/ is an affixal-vowel as in (17 and 18). From the previous analysis, a root-vowel is known to be lexically significant for which reason it must be retained over an affixal-vowel (i.e., the one which is not lexically significant). Here, it is rather /e/, a root-vowel which is omitted, /a/, the affixal-vowel, is rather retained, and not only retained. It is also lengthened, as we can see from the licit forms in (17f) and (18f). [6]

(17) **Kubease** "beneath the coconut tree"
Input: (a) **/kube-asɪ/**
Output: (b) ***kubeasɪ**, (c) ***kubesɪ**, (d) ***kubasɪ**, (e) ***kubeesɪ**, (f) **kubaasɪ**

(18) **Topease** "sight of snails"
Input: (a) **/tope-asɪ/**
Output: (b) ***topeasɪ**, (c) ***topesɪ**, (d) ***topasɪ**, (e) ***topeesɪ**, (f) **topaasɪ**

(19) *Avoidance of [-low] lengthening/doubling; [+low] lengthening is preferable*
(a) ***kubeesɪ** ~ **kubaasɪ**
(b) ***topeesɪ** ~ **topaasɪ**

This is a clear case of competing demands – it seems like /e/ must be omitted for some reason, but there is also the need to preserve its syllable through regressive [+low] lengthening for some other reason. From the preferred output forms, there are two well-formedness requirements that possibly underline vowel processes here, namely (i) phonotactic well-formedness and prosodic well-formedness. Prosodically, the input forms in (17) and (18) are a clear case of an input having met all relevant prosodic requirement such that there is no need to delete a syllable – for which reason the omission of /e/ for any other reason(s) must be compensated for through [+low] lengthening. That is, the fact of the matter is that there is technically a four-syllable minimum requirement on place-names (i.e., a prosodic wellformedness constraint) which these input forms have met for which reason they cannot lose a syllable. At the same time, the language does not allow [-high][-high] vowel sequence (i.e., a phonotactic constraint) for which reason the /e^+a/ vowel sequence must not be allowed

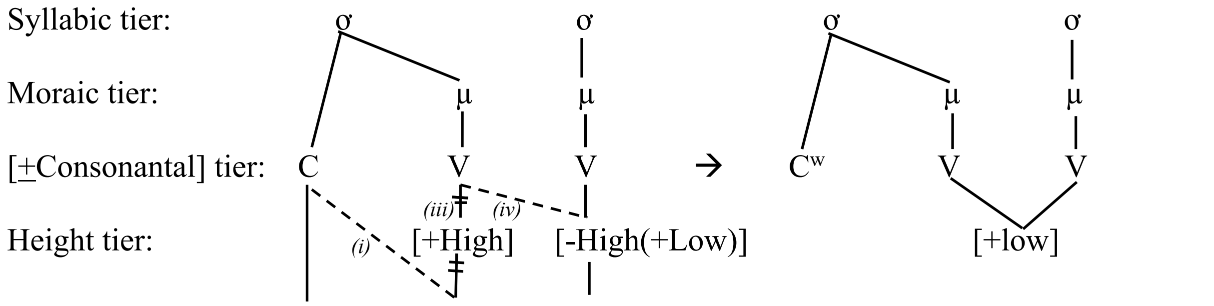
[6] An anonymous reviewer suggested height assimilation as the process involved here rather than deletion. They were of the view that the analysis would be simpler in that regard than my deletion and compensatory lengthening stance which involves two processes. The fact of the matter is that the height assimilation solution is not simple. The height assimilation account also involves the deletion of a feature, which is the feature [-Low] of /e/. I settled on /e/ deletion and vowel doubling because [-Low] is not the only feature that gets deleted here; /e/ is also [+ATR] and this feature also gets lost in the realization of /e/ as [a]. Additionally, avoidance of the feature sequence $V_{1[\text{-High}]}V_{2[\text{-High}]}$ (i.e., OCP[-High]) is the primary segmental motivation for vowel processes in this lexicalization process, which Akan resolves by deleting one of the adjacent vowels.

in output forms. Another observation is the fact that in the bid to avoid the [-high][-high] feature-sequence, it is the feature [+mid] of /e/ that is deleted, the feature [+low] of /a/ is preserved and is what is lengthened to compensate for the loss of [+mid]. That the feature [+low] is preserved over [+mid] is significant to the theory of markedness and of sonority. The impermissible [-high][-high] feature-sequence is resolved in favor of the vowel with the feature that is more sonorous and/or is more marked. The low vowel, while not being the lexically significant vowel, is the more sonorous or marked of the two vowels, to be preserved to avoid the [-high][-high] feature sequence (i.e., so to respect phonotactic wellformedness). Regressive [+low] lengthening applies to achieve prosodic wellformedness (i.e., to counter the effect of the phonotactic which could reduce the number of syllables from four to three). That is, in the current context, Akan grammar opts for the /e/ deletion to be followed (i.e., compensated for) by regressive /a/ lengthening – merely on the count of the relative strength of vowels in the sequence – that is, their comparative strengths in terms of either markedness or sonority. The deletion of /e/ over /a/ (with /a/'s subsequent regressive compensatory-lengthening) is an indication of a preference, in Akan grammar, for the deletion of the less-marked, less-sonorous vowel in the sequence over the relatively more marked, more sonorous vowel (i.e., the low vowel, /a/). What the analysis above presents to us is the fact that there comes a time when the condition(s) prevailing in a lexical context is/are such that certain significant functional information that must be enforced would rather have to be overlooked just because phonotactic well-formedness, which principles of sonority and markedness help to deploy relevantly, is an equally important consideration which must be pursued in tandem with the genuine quest for prosodic well-formedness. The fact of the matter is that, in Akan, domains of linguistic (i.e., segmental or featural) change or alternation without accompanying changes in meaning or functions (such as the above) usually are domains of non-contrast of the units in alternation or alteration. This is what pertains in the case of /e/ and /a/ in the present context. Therefore, a purely segmental factor – phonotactic well-formedness defined in terms of markedness and/or sonority – is what dictates impermissible [-high][-high] vowel-sequence resolution.

The vowel sequence at the stem-stem boundary in (20) is /o^{+}a/; here also, it is V1 (i.e., the root vowel), which is /o/, which is affected in the course to prevent the impermissible [-high][-high] vowel sequence. First, the preceding consonant gets labialized before /oa/ (i.e., C^{w}oa) before /o/ is finally deleted. /a/, the affixal vowel, remains and lengthens regressively to compensate for the loss of /o/. It can be said that consonant labialization occurs in the context: __oa; /o/ (a round non-high vowel) deletion occurs in the context: C^{w}__a; regressive /a/ lengthening applies in order to provide the information relevant to avoid prosodic ill-formedness.

(20) **Dompoasɪ** "beneath dompo tree"
(a) Input: **/dompo-asɪ/ →** (b) (i) **[dompo-asɪ]** ~ (ii) **[dom.p^{w}a.a.sɪ]**

(21) *[+high] derounding and deletion, and regressive [+low] spreading*



		(ii)			
Place tier:	[PLACE]	[LAB]	[DOR]		= **[dom.pʷa.a.sɪ]**

(i) consonant labialization, (ii) [+high] derounding,
(iii) deletion of [+high], (iv) spread of [+low]

In (22), vowels in sequence at the stem-stem boundary possess the height features, [+high][-high]. Here, [+high] (a root vowel) deletes and the low (i.e., an affixal) vowel lengthens to compensate for the loss. Consonant labialization as described for (20) applies here as well. The [+high] deletion rule in this case interrupts the rules on consonant labialization and /a/ compensatory lengthening just as described for (20) in a sequence of feeding relations.

(22) **Mangoase** "beneath the mango tree"

(a) Input: **mangʊ-asɪ →** Output: **maŋ.ŋʷa.a.sɪ**

Consonant labialization as described in (20) and (22) is motivated by the need to preserve a (more) contrastive – or non-predictable – feature in the phonological context before a vowel could be subjected to deletion. It is this contrastive feature transfer, or fronting, (which, as it applies, leaves the affected vowel with less contextually-significant features) which renders V_1 amenable to deletion. That the grammar goes to the extent of transferring salient features so that the impermissible vowel-sequence: ***[-high][-high]** (as in 20 and above) and ***[+high][-high]** (as in 22), can be avoided reveals the extent of dispreference of these sequences and, for that matter, the importance of the need to really prevent them somehow when they could occur. Consonant labialization also helps to create the predictable context in which a vowel can be deleted; this is necessary for ease of recoverability of the affected for the avoidance of any possible meaning change or ambiguity. In the case of the *[+high][-high] vowel sequence, /ʊ/ becomes amenable for deletion by virtue of the fact that it is possessive of the features [+high] and [-ATR], both of which are the default/unmarked height and ATR values respectively in Akan grammar; and also the fact that its sole lexically contrastive [+round]/[labial] feature exists in the neighborhood (i.e., in the form of a secondary articulated feature ʷ on the preceding consonant). It (i.e., /ʊ/) becomes easily recoverable (or predictable) then in this context for which reason its high feature can be omitted over the [-high] of /a/, the less predictable of the two vowels in the sequence. There are domains in which the remaining featural properties of a high vowel are not (easily) fully recoverable for which reason a high vowel cannot be deleted, even though it is still a requirement that the [+high][-high] vowel sequence must not be tolerated.

It is always a requirement to keep a root vowel over say an affixal vowel such that in the absence of predictability (as non-predictability could result in meaning difference), it cannot be deleted. In other words, a root high vowel resists deletion just because the context is not ripe for deletion (i.e., does not allow for its deletion). Such is the case in (23) in Twi; /ɪ/ deletion cannot become the means by which the impermissible *[+high][-high] vowel sequence is avoided in the Twi dialects of Akan. The Twi dialects, therefore, resort to glide formation which is triggered by /ɪ/ to onset the following non-high vowel as illustrated in (23b-i); and this is how the Twi dialects avert the impermissible *[+high][-high] vowel sequence superficially.

(23) **Besease** "beneath the cola tree"

(a) Input: **bɪsɪ-asɪ** → (b) (i) **bɪsɪjasɪ** (Twi), (ii) **bɪsʲaadzɪ** (Mfantse/Fante)

This onset glide, per the current data, is realized as [j] with the contrastive/non-predictable V_1 as high and unrounded, and occurs to preserve [+high] and [-high] simultaneously. More significantly, j-glide formation applies to prevent the [+high][-high] vowel sequence and equally works to insulate V_1 ([+high]), a lexically significant vocalic/root unit, from /a/'s (i.e., [-high]) encroachment and, therefore, its (i.e., V_1's) consequent deletion.

/ɪ/ deletion is allowed in the [+high][-high] vowel sequence when its onset has been coronalized/palatalized. The consonant undergoing coronalization/palatalization must not be a liquid. The context of consonant coronalization/palatalization, therefore, is as follows: $C_{[-LIG]} \rightarrow C^{j}$ /__$V_{[+high]}V_{[-high]}$). The derivation of this context then makes /ɪ/ amenable to deletion, after which there must be a regressive /a/ lengthening to compensate for it. These series of feeding rules are what derive the output form in (b-ii) as in the Fante dialect of Akan. Here, the two major dialects (i.e., Twi and Fante) can be said to differ merely in their direction of spread of coronality/palatality in their bid to prevent the impermissible *[+high][-high] vowel sequence – which in the Twi dialects is to the right to an onset-slot (i.e., to provide an onset for the succeeding onsetless vocalic syllable), but to the left in Fante (i.e., also to an onset-slot, this time, as a secondary articulated feature on the consonant there).

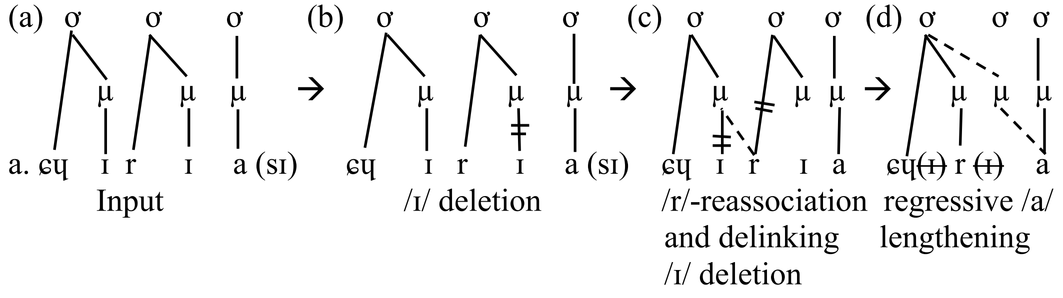
/ɪ/ deletion cannot be completely ruled out in the Twi dialects. There are domains whereby this can be permitted. The following two contexts and rules come to mind: (i) $V_{[+high/\gamma round/\beta ATR]} \rightarrow \emptyset / V_{[\pm high/\gamma round/\beta ATR]}r$ __ $V_{[-high]}$; or (ii) $V_{[+high/\gamma round/\beta ATR]} \rightarrow \emptyset$ / $C_{[-LIG]}$ __ $rV_{[\pm high/\gamma round/\beta ATR]}$, that is, in a domain where a deleting high vowel shares a boundary with [r] and there is another vowel which also shares a boundary with [r] with which the deleting high vowel harmonizes in rounding and in tongue root advancement.

(24) Input: **/aɕɥɪrɪ-asɪ/**; Ouput: **[a.ɕɥra.a.sɪ]**; Orthography: **Ahwerease**

(a) **/aɕɥɪrɪ-asɪ/** → (b) **aɕɥɪrØ-asɪ** → (c) **aɕɥØrØ-asɪ** → (d) **aɕɥØra-asɪ** → (e) **a.ɕɥra.a.sɪ**

The first of the two rules above (i.e., i) applies to delete /ɪ/ at the stem-stem boundary (as illustrated non-linearly in (25b)). The second rule (ii), deletes the initial /ɪ/ (before /r/) as in (25c), caused by /r/ nuclear-association with the preceding syllable (also represented in 25c). That is, regressive /a/ lengthening compensates for the loss of the stem-boundary /ɪ/, and /r/ nuclear-reassociation for the loss of the non-boundary/initial /ɪ/. These processes work together to reduce what are three syllables into a bimoraic monosyllable, i.e., ɕɥɪ.rɪ.a → [ɕɥra]. That is, the resultant output form as in (24e), a.ɕɥra.a.sɪ, is perceived to be consisting of four syllables, namely: [a], [ɕɥra], [a] and [sɪ]; that is, with [ɕɥra] conceived as a bimoraic monosyllable. Represented below in (25) is the derivation of the [Cra] (i.e., [ɕɥra]) bimoraic monosyllable.

(25) Reduction of three syllables into a bimoraic monosyllable



= $_{\sigma 1}$[**a.**$_{\sigma 2}$[**ɕɥra.**$_{\sigma 3}$[**a.**$_{\sigma 4}$[**sɪ**

That is, with a liquid onset before [+high], the impermissible *[+high][-high] vowel sequence is prevented through [+high] deletion and the other segmental processes discussed above (and captured in (25)) follow accordingly just in promotion of prosodic well-formedness. In (26), the stem boundary vowel /ʊ/ deletes on account of the (non-boundary/initial) /ʊ/ before /r/. Therefore, this deletion becomes more predictable.

(26) /takʊrʊ-asɪ/ Orthography: Takrowase ~ Takorase

(a) Input: **takʊrʊ-asɪ** → (b) Output: **takʊrasɪ**

The non-boundary/initial /ʊ/, however, cannot be deleted for lack of predictability; the vowel is labial/[+round] and the fact that there is no labial/[+round] in the environment annuls any attempt at deleting this initial /ʊ/. Also, regressive /a/ lengthening which must apply to compensate for the loss of the preceding/boundary vowel (and more importantly to preserve prosody) is blocked here by the fact that this effort will create more than the four-syllable-minimum required in this case. That is, the grammar obviates the prosodic anomaly that could result by joining /r/ and /a/ in a single syllable and thus, by so doing, reducing the five underlying syllables into four syllables superficially. We cannot skip an alternative pronunciation of the place-name in (26a), as in (27b).

(27) (a) **takʊrasɪ** → (b) **ta.k^{w}ra.a.sɪ**

With this output form, there is consonant labialization making the initial /ʊ/ very predictable to be deleted. The outcome of this rule feeds /ʊ/ derounding/delabialization and with /ʊ/ delabialized to [ɪ], [ɪ] is deleted to derive the sequence C^{w}r… The rules therefore are:

(28)
(a) Consonant labialization: C → C^{w} / __ V$_{[+round]}$r…
(b) /ʊ/ derounding: /ʊ/ → [ɪ] /C^{w}__r…
(c) [ɪ] deletion: [ɪ] → Ø /C^{w}__r

Here, also, the syllable sequence, kʊ.rʊ.a (three syllables) gets mashed into a single bimoraic monosyllable, [k^{w}ra] (see 25d). Here, regressive /a/ lengthening is required to provide a nuclear-segment for [k^{w}r_] and to satisfy the minimum syllable required. Another pronunciation of this place-name is as in (29c).

(29) (a) **ta.kʊ.rʊ-a.sɪ** → (b) **ta.kʊ.rʊ.wa.sɪ** → (c) **ta.krʊ.wa.sɪ**

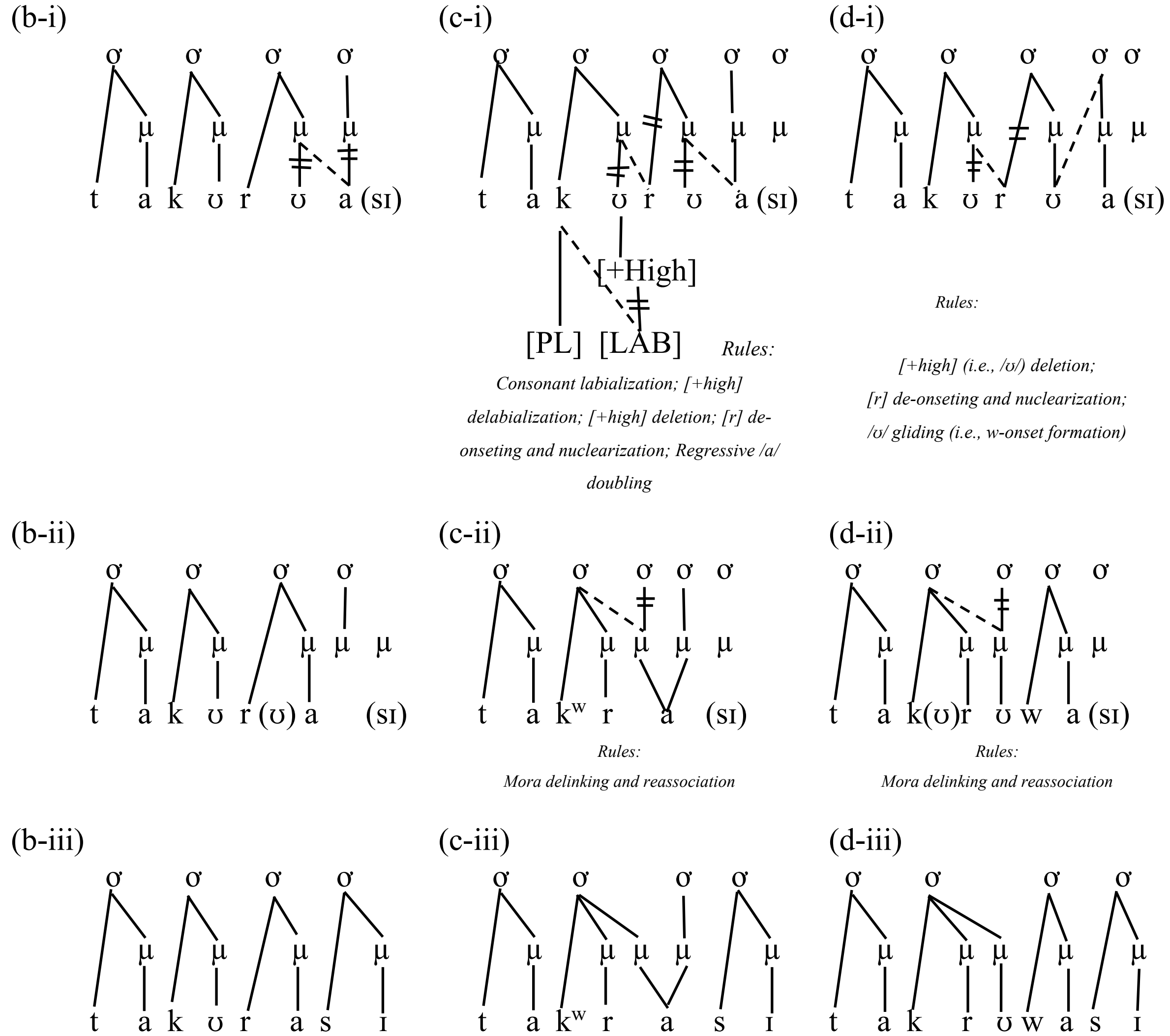
Here, the boundary /ʊ/ supplies onset for /a/ (i.e., w-onset/glide formation as in (29b)) and this is how the impermissible *[+high][-high] vowel sequence is avoided; then the grammar resorts to /r/ delinking as onset and its reassociation to a preceding nuclear-slot resulting in the initial /ʊ/ being deleted just in the manner represented in (25c) above. Here, the derived bimoraic monosyllable is [krʊ] from just two underlying syllables, /kʊ.rʊ/.

Below in (31) are non-linear derivations of the tri-alternants of /takʊrʊ-asɪ/ as discussed above – the representations have more information than I have been able to discuss above since my intention has been to limit the discussion to the creation of bimoracity and to stem-stem boundary processes.

(30) *Alternation in **takʊrʊ-asɪ***
Input: **takʊrʊ-asɪ** → (b) **ta$_{1}$.kʊ$_{2}$.ra$_{3}$.sɪ$_{4}$** ~ (c) **ta$_{1}$.k^{w}ra$_{2}$.a$_{3}$.sɪ$_{4}$** ~ (d) **ta$_{1}$.krʊ$_{2}$.wa$_{3}$.sɪ$_{4}$**

(31) Non-linear representations of the three forms of: (a) Input: /**takʊrʊ-asɪ/**

(30b/31b) ***[ta.kʊ.ra.sɪ]*** *(30c/31c)* ***[ta.kʷra.a.sɪ]*** *(30d/31d)* ***[ta.krʊ.wa.sɪ]***



6. Phonological processes associated with emu-based and ɛsʊ-based place names

This section is devoted to phonological processes associated with **emu**- and **ɛsʊ**-based place names.

6.1 Phonological processes associated with **emu**-based place-names

Below in (32) are place-names with **emu** "within, interior" as the partative noun.

(32) *Emu-based place names data*

Input Output Orthography Meaning

a.	**a-ɲina-emu**	**æɲinæ-m**	**Anyinam**	"area of silk-cotton plants"
b.	**a-wisa-emu**	**æɥisæ-m**	**Awisam**	"area of ground.pepper plant"
c.	**a-waha-emu**	**awahæ-m**	**Awaham**	"area of awaha leaves"
d.	**aɲɥɪa-emu**	**aɲɥɪjæ-m**	**Anweam**	"area of sand" (non-count noun)
e.	**a-baa-emu**	**abææ-m**	**Abaam**	"area of abaa trees"
f.	**a-bʊɔ-emu**	**abʊo-m**	**Aboɔm**	"area of rocks"
g.	**N-bɪpɔ-emu**	**mmɪpo-m**	**Mmepom**	"area of mountains"
h.	**a-mako-emu** → **amæko-emu**	**amæko-m**	**Amakom**	"area of pepper plants"
i.	**a-suo-emu**	**æsᶣuo-m**	**Asuom**	"area of rivers"
j.	**a-kwadu-emu**	**akwædu-m**	**Akwadum**	"area of banana plants"

Here, **emu** is reduced in form drastically becoming an enclitic, [-m]. In sentences where emu is an independent word, it is realized fully as **emu** at the sentence initial position (e.g. **emu ayɛ fi** "(The) interior has-become dirty"), but as **mu** after another word – and here, the final sound of the preceding word does not matter. Generally, any noun that begins with any mid-vowel (i.e., [e], [ɛ], [ɔ] [o]) submits to this deletion process. Therefore, this rule will be expressed generally to account for all cases of mid-vowel deletion in nouns. The rule outside of the phonology is as given in (33) below. An initial mid-vowel of a noun deletes after a morpheme. The interpretation of the rule as in (27) is in the spirit of the rule in (5c): [+low] → Ø / $[+low]^{+}$__, with non-linear representations in (6a-ii/6b-ii/9b) above. Both rules demand that an affixal unit deletes over a root unit. In other words, the preference condition is that, where there is the need for deletion, an affixal unit (i.e., vowel) deletes over a root final segment. Here, the affixal unit is a mid-vowel (not a low vowel as in 5c), and therefore is the unit that deletes.

(33) (a) [-high/-low] → Ø / $X]_{\text{MORPHEME}}$ __$C\ldots]_{\text{NOUN}}$

(33b) $[\text{-high/-low}]_{\sigma}$ → Ø /σ __σ

The rule that applies to delete the affixal mid-vowel as in (33a) can be expressed prosodically/syllabically as in (33b). As illustrated in (33b), a mid-vowel syllable deletes inter-syllabically. There is no need to be specific about the segmental content of the surrounding syllables because the rule applies irrespective of the shape/size and/or quality of the surrounding syllables. The shift in focus to the syllable in the present circumstance, therefore, is quite significant. The application of the rule in (33b) is motivated by the fact that, in Akan, a mid-vowel syllable is weak, and therefore is amenable to deletion, inter-syllabically. The same has been identified about syllabic high vowels in the language (Ofori 2012; 2019). So, in terms of the strength of intersyllabic onsetless syllables, the ranking in Akan is: syllabic:[+low] >> syllabic:[-high/-low] >> syllabic:[+high]. This underlies the syllabic [-high -low] vowel deletion over the syllabic:[+low] as obtained in (32d) and (32e). This equally has relevance to the markedness and sonority scales with the [+low] vowel being the most marked or sonorous, followed by mid-vowels and followed by high vowels, and underlies [e] deletion before [a] from (32a) to (32e). Among vowels of the same height (i.e., either high or mid), the round ones outrank the non-round ones in markedness and in sonority – i.e., [-high/-low]: (ɔ >> o >> ɛ >> e) >> [+High]: (ʊ >> u >> ɪ >> i). This accounts for the syllabic-[e] deletion before either [o] or [ɔ] from (32f) to (32i). The fact that [e] is more sonorous, more marked than /u/, but, in (32j), it is [e] that deletes suggests other considerations here. /u/ is preserved over [e] in (32j) on account of it (i.e., /u/) being a more lexically-significant unit than [e]; /u/ and [e] are not within the same height range: /u/ is a high vowel and [e], a mid-vowel; any attempt at replacing a root-vowel of one height region (e.g., high) by another vowel of another height region (e.g. non-high) would often lead to a meaning change – and this explains why even though /u/ is the less marked and the less sonorous unit compared to [e], it is [e] that must be deleted. This is the idea or reasoning which guides the vowel harmonies in Akan such that both [+ATR] harmony and [+round] harmony applications stay within the same height zone as any drastic change in height is likely to cause some difference in meaning. That is, technically, non-lexically significant alternation or alteration processes (i.e., phonotactic well-formedness processes) turn to stay within definable articulatory zones of non-contrast for given domains so to preserve meaning.

[+ATR] harmony in Akan can be considered a lenition process by which underlyingly [+ATR] vowels impose or transmit their [+ATR] feature on underlyingly [-ATR] vowels which in terms of sonority are stronger – i.e., a kind of sonority lowering/minimizing mechanism. Such surface realizations of the feature [+ATR] – and other [-ATR] to [+ATR] feature changes in the language – are mainly permitted in domains of [±ATR] non-contrast. An [+ATR] bearing unit given its weaker sonority status initiates [+ATR] harmony to insulate itself from modification to preserve lexical contrast. There are very fascinating [+ATR] harmony cases in the current data that warrant attention. I will reference the relevant data to illustrate them. [+ATR] harmony, in the current data, is strictly anticipatory (i.e., regressive), and holds between abutting vowels of adjoining stem-words. Technically, the [+ATR] feature in transmission emanates from a lexically significant vocalic-segment. That is, the [+ATR] unit/trigger must always be a contrastive feature of a contrastive root segment; this suggests that [e] of **emu** deletes before the spread of [+ATR] from /u/, a contrastive root-segment. Note that the root of **emu** (i.e., a stem) underlyingly **{ɛ-mu}** is **{mu}** – that is, the prefix of **emu** is underlyingly {ɛ-}; /ɛ/ underwent [+ATR] harmony to [e] because of /u/ in the citation form of this partative stem hence **[emu]**. The rule in (33) illustrates the deletion of /ɛ/ (before [+ATR] harmony) or [e] (after [+ATR] harmony] (and the deletion of other mid-vowels, ɔ and o). The rule in (34a) illustrates /a/ ([+ATR]) conversion (i.e., lenition) to [æ] ([+ATR]) for output forms from (32a) to (32e); and (34b) illustrates /ɔ/ ([-ATR]) lenition to [o] ([+ATR]) as in (32f) and (32g).

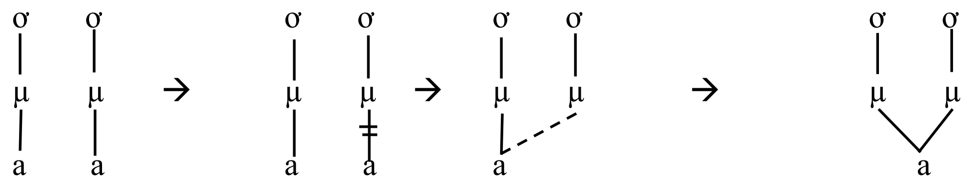
(34) *Linear representations of the regressive [+ATR] harmony rule in Akan*
(a) /a/ ([-ATR]) → [æ] ([+ATR]) / __$^{+}$[mu(+ATR])
(b) /ɔ/ ([-ATR]) → [o] ([+ATR]) / __$^{+}$[mu(+ATR])
(c) [-ATR] → [+ATR] / __$^{+}$[+ATR]

Stem boundary vowels from (32h) to (32j) (o, u) enter into the process as already [+ATR] – but if they had been /ɔ/ and /ʊ/, they definitely would have been converted to [o] and [u] respectively to harmonize with /u/ in its feature [+ATR]. The rule in (34) consists of shared properties of (34a) and (34b), and is a more general [+ATR] harmony rule for the moment (that is, ignoring consonants for their inertness in this process), while in (32a) to (32d) and in (32f) and (32g), the spread of [+ATR] affects a single vowel. In (32e), however, the two low vowels both receive the feature [+ATR]. In (32f), there is an underlyingly /ʊɔ/ vowel-sequence (with a [w] glide-onset between them phonetically). /ʊ/ does not change to [u] in [+ATR] harmony because it is not immediate to the trigger, /ɔ/ rather is. Therefore, it is only /ɔ/ that harmonizes with the trigger (i.e., /u/) in [+ATR]. There is the temptation to invoke vowel quality here by saying that possibly in order for [+ATR] to spread regressively to more than a single [-ATR] vowel, the target vowel must be of a certain quality (in this case, [+low]). The problem with this position is that **[a-waha-mu]** undergoes [+ATR] harmony to (32c) **[a-wahæm]**, but not to

***[a-wæhæm]** or ***[æwæhæm].** The example above suggests that a low vowel which is a vowel away from the [+ATR] trigger does not participate in the harmony process. This position is, however, contradicted by the licit-output form in (32e) **[abæ₁æ₂-m]** where **æ₁** (which seems to be a vowel away from the trigger) joins with **æ₂** (i.e., the vowel that is immediately followed by the [+ATR] trigger) to undergo [+ATR] harmony. If we look carefully, we will realize that (32c) **awa₁hæ₂-m** and (32e) **[abæ₁æ₂-m]** are structurally not the same. In (32c), the two low vowels in consideration (i.e., **a₁** and **a₂**) are discontiguous (i.e., separated by /h/), as opposed to contiguous (i.e., without a consonant to interrupt their sequence) in (32e). My proposal is that there is [+Low] OCP with underlyingly contiguous low-vowels; the OCP[+Low] constraint is avoided with a low vowel becoming doubly-associated. The argument therefore is that seemingly low-low vowel sequence in (32e) **[abæ₁æ₂-m]** is rather a case of a doubly-associated low vowel – a single low-vowel segment that belongs to two syllables simultaneously. The present stance receives support from Ofori (2008: 91) in his account of numeral compounding in Akan. According to Ofori (ibid), contiguous low vowels submit to the OCP[+Low] constraint prior to the application of the [+ATR] harmony rule; therefore, these independent (but contiguous) vowels come to have a single [+Low] node to which the trigger transmits the feature [+ATR], from where it percolates to the adjoined low-vowels. In other words, the reason low vowels in (32e) participate in [+ATR] harmony (as opposed to their discontiguous counterparts in (32c)) lies in the manner in which the OCP[+Low] condition is resolved in Akan grammar – i.e., a single multiply/doubly-associated [+Low]-node is preferred over independent contiguous [+Low]-nodes. By adopting this multiply/doubly-associated stance on contiguous low vowels, my analytical position is that [+ATR] harmony in stem-stem compounding holds strictly between two vocalic segments, and that it is realized by the regressive transmission of a contrastive [+ATR] feature of a contrastive root-vowel to a preceding vowel (when the [-ATR] feature of the target vowel is or has become non-contrastive). Below in (35a) is a linear representation of low-vowel doubling, with non-linear representations in (35b and 35c).

(35) (a) Avoidance of the low-low vowel sequence: **[+low] → [:] / [+low] ___**
(b) Avoidance of independent contiguous [+low] vowels (i.e., OCP[+low]?)

(i) *Input:* (ii) *Avoid /aa/*: (iii) *Prosodic well-formedness:* (iv) *Output:*



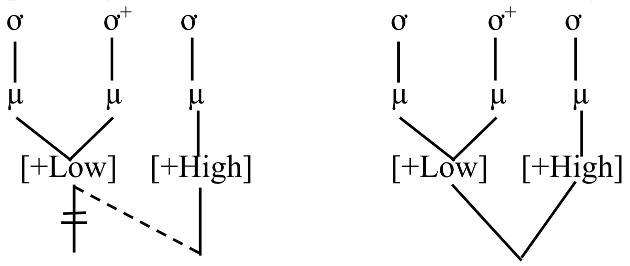
(c) The spread of [+ATR] to the doubly-associated [+low] vowel

(i) Spread of [+ATR] *(ii) [+ATR] harmony*

Syllable Tier:

Moraic Tier:

Height Tier:



$\rightarrow$

[ATR] Tier: [-ATR] [+ATR] [+ATR]

The discussion below focuses on rule relations. Given the underlying partative here as /ɛmu/, following are the rules that must interact to derive the enclitic [-m] in place-names here. Three rules are involved here: (36a, 36b and 36c), and are in a feeding relation in the order in which they have been presented. The rule in (36a), as has been discussed previously, is responsible for the loss of /ɛ/ (i.e., the mid-vowel); then there is a regressive spread or assimilation of the contrastive feature, [+ATR], of a root vowel to replace the feature [-ATR] of the immediate vowel as represented in (36b).

(36) (a) Mid-vowel deletion: **$[\text{-high/-low}]_\sigma \rightarrow$ Ø / σ__σ**
(b) [+ATR] harmony at the root-root boundary: **[-ATR] $\rightarrow$ [+ATR] / __$^{+}$[+ATR]**
(c) /u/ deletion: **[+High, αATR, ɣPLACE] $\rightarrow$ Ø / $CV_{[\alpha ATR]}C_{[\gamma PLACE]}$ __ #**

Once the root feature [+ATR] has been preserved in a [+ATR]-harmony with the preceding vowel then this vowel can be deleted in the manner expressed (36c). The rule in (36c) holds for all high vowels, but for our current purpose it is simply in reference to the loss of /u/. Therefore, the use of the term [PLACE] is in reference to [LABIAL], which both /u/ and /m/ share. /u/ can be deleted when the preceding vowel either inherently or derivationally harmonizes with it in the feature [+ATR] and is also made possible by the fact that /u/ harmonizes with /m/ in labiality. Therefore, the rule in (36c) can be stated more specifically as in (37):

(37) **[+High, αATR, ɣLABIAL] $\rightarrow$ Ø / $CV_{[\alpha ATR]}C_{[\gamma LABIAL]}$ __ #**

The rule in (37) counterbleeds the rule in ((36c) as it applies to remove the trigger of [+ATR] harmony. Also in a feeding relation is the rule on [+low +low] vowel sequence reduction in (35a/b) and the [+ATR] harmony rule as in (35c/36b). (35a/b) feeds (35c/36b); that is, (35a/b) creates the context for the spread of the feature [+ATR] (i.e., as a result of the need for [+ATR] harmony) to a doubly-associated [+low] vowel.

6.2 Phonological processes associated with ɛsʊ-based place-names

The data in (38) concerns place-names with the partative noun, /ɛsʊ/ "top, vicinity, basin". These place names basically help to locate a place in relation to a known river. That is, the name of the river is qualified by /ɛsʊ/ to depict and name the place concerned – i.e., this place then is a place of the river. The rule as in (36a) becomes more significant here, that is, with /ɛsʊ/ emerging as [sʊ] on the surface.

(38)

Underlying	Phonetic	Orthography	English gloss
a. **apaa-ɛsʊ**	**a.pa.a.sʊ**	**Apaaso**	"basin/vicinity of river apaa"
b. **pɪra-ɛsʊ**	**pra.sʊ**	**Praso**	"basin/vicinity of river Pra"
c. **akʊkʊa-ɛsʊ**	**a.kʊ.kʊ.a.sʊ ~a.kʊ.kwa.sʊ**	**Akokoaso**	"basin/vicinity river of Akokoa"
d. **ɔfɪn-ɛsʊ**	**ɔ.fɪn.sʊ, *ɔ.fɪ.nɛ.sʊ**	**ɔfenso**	"basin/vicinity of river ɔfen"
e. **bɔm-ɛsʊ**	**bɔm.sʊ, *bɔ.mɛ.sʊ**	**Bɔmso**	"basin/vicinity of river Bɔm"

f. **fum-ɛsʊ** **fum.sʊ, *fu.mɛ.sʊ** **Fumso** "basin/vicinity of river Fum"

In (38a, b and c), /a/ is retained and /ɛ/ deletes - /a/ is a root vowel, more sonorous and more marked than /ɛ/ (which is an affixal vowel). That is, all the requirements for retention favor /a/ over /ɛ/. In (38d, e and f), names of rivers end in nasal consonants /m, n/ and, here, /ɛ/ could have remained to provide a nucleus for these consonants and yet that preference condition is overlooked. /m/ and /n/ remain nucleuses, but not as independent syllables; they join with the preceding CV to construct a bimoraic monosyllable. The evidence that these boundary consonants come to belong more to the preceding syllable in the derived output forms is the absence of place harmony between /m/ and /s/ as in (38e) and (38f); these nasal consonants have a feature bond with the preceding vowel, namely: coronal-coronal in (38d) – i.e. between /ɪ/ and /n/; and labial-labial in (38e and f) between /ɔ/ or /u/ and /m/. The loss of /ɛ/ after /m, n/ is due probably to the fact that the sequences: [nɛ] and [mɛ] could affect meaning in that context, therefore, the need to avoid such sequences.

The four-syllable requirement proposal on partative place-names seems to be in disrepute here since of the six-preferred output forms only two (38a) and (38c) satisfy this prosodic requirement; even in (38c), there is a five-syllable alternant of the four-syllable output for older speakers. That fact of the matter is that Akan grammar could have kept /ɛ/ and, by so doing, could have either met the four-syllable requirement or come close to it, and yet here the language does not find it prudent to sacrifice segmental/phonotactic well-formedness for prosodic well-formedness, or vice versa. In the ensuing section, I establish the mechanisms that the language implements to maneuver these competing demands meaningfully (i.e., as its grammar dictates and prescribes).

7. Linear rules and some explanations of them

Key among the rules discussed and formulated in section (5) and (6) are as found in (39) below.

(39) *Some rules from the analysis*

(a) [+low] → Ø / [+low]$^{+}$__
(b) [-high/-low] → Ø / [+low]$^{+}$__
(c) [-high/-low] → Ø / __$^{+}$[+low]
(d) [-low] → Ø / #__$^{+}$
(e) $V_{[+high/\gamma round/\beta ATR]}$ → Ø/$V_{[\pm high/\gamma round/\beta ATR]}$r __ $V_{[-high]}$
(f) $V_{[+high/\gamma round/\beta ATR]}$ → Ø / $C_{[-LIG]}$ __ r$V_{[\pm high/\gamma round/\beta ATR]}$
(g) Consonant labialization: C → [C^{w}] / __ [+high, Lab] [-high]
(h) [+high] derounding/delabalization: V[+high/lab] → [cor] / C^{w} __ [-high]
(i) [+high, cor] → Ø / C^{w}__[-high]
(j) $V_{[+high/Cor]}$ → Ø / $C_{[DEL,\ CORONALIZED]}$ [__]$_{\sigma}$.[+LOW]$_{\sigma}$…
(k) Non-liquid consonant palatalization $C_{[-LIG/-PAL]}$ → C^{j} /__$V_{[+high]}V_{[-high]}$)
(l) $V_{[+high/Cor]}$ → Ø / $C_{[-LIG,\ CORONALIZED]}$ [__]$_{\sigma}$.[+LOW]$_{\sigma}$…
(m) /u/ deletion: **[+High, αATR, ɣPLACE] → Ø / CV$_{[\alpha ATR]}$C$_{[+SON,\ \gamma PLACE]}$ __ #**
(n) /a/ ([-ATR]) → [æ] ([+ATR]) / __$^{+}$[mu(+ATR])
(o) /ɔ/ ([-ATR]) → [o] ([+ATR]) / __$^{+}$[mu(+ATR])
(p) [+ATR] harmony at the root-root boundary: **[-ATR] → [+ATR] / __$^{+}$[+ATR]**
(q) Mid-vowel deletion: **[-high/-low]$_{\sigma}$ → Ø / σ__σ**
(r) Avoidance of the low-low vowel sequence: **[+low] → [:] / [+low] ___**

As stated in (39a), a low vowel as an affix deletes over a low vowel as a root vowel. In (b) and (c), a mid-vowel (i.e., [-high/-low]) always deletes over a low vowel irrespective of their affixal or root information. In (b), the mid-vowel is an affix and deletes over the root low vowel; in (c), the mid-vowel is a root vowel and still deletes over the low vowel which is an affix. In (d), a non-low vowel (specifically, a mid-vowel) deletes at the compound stem's initial position. This rule is violated by **[oduması]** which cannot drop its initial [o] vowel because the initial [o] is lexically significant.

A high vowel is deletable when it shares a boundary with /r/ and its round and ATR values are predictable from a neighboring vowel as in (e) and in (f). In (e) where the deleting high vowel is followed by a non-high vowel, the retention of the high vowel is a violation of *[+high][-high] – therefore, the high vowel deletes. The rule in (f) works well in non-boundary cases when it becomes necessary to create a bimoraic monosyllable to satisfy the four-syllable requirement. In domains where the round and ATR values of a high vowel are not predictable from context, the environment must be made predictable before a high vowel can be subjected to deletion in a bid not to violate *[+high][-high]; if the high vowel is labial (i.e., rounded) it must store this feature in the preceding consonant. The rule in (g), therefore, is about this; in this context, the high vowel harmonizes with the non-high vowel in being [-ATR]. Consonant labialization then triggers high vowel delabialization as expressed in (h). In (i), the delabialized high vowel can then delete. (j) is another instance of [+high, cor] deletion between a palatalized/coronalized affricative and a non-high vowel (specifically, the low vowel). Also, in a few cases, a non-palatal, non-liquid consonant will undergo palatalization before a high coronal vowel would be deleted to respect the *[+high][-high] (+low) vowel sequence; therefore, the rule in (l) can be said to be triggered once consonant palatalization as in (k) has applied.

In (m) is word final /u/ deletion, this deletion is made possible by the fact that /m/ can function independently as a syllable and /u/ shares with /m/ the feature labial. It harmonizes with the vowel of the preceding CV-syllable in the feature [+ATR] for which reason its omission is not semantically costly. A more specific rewriting of this rule is [+High, αATR, ɣLAB] $\rightarrow$ Ø / $CV_{[\alpha ATR]}C_{[+NASAL,\ \gamma LABIAL]}$ __ #. As specified in (n) and (o), /u/ triggers [+ATR] in a preceding [-ATR] vowel before the rule as specified in (m) can apply suggesting a feeding relation between the two rules. In (p) is a cover [+ATR] harmony rule for our present purpose – we can remove the morpheme boundary sign (i.e., +) to make this work broadly in regressive [+ATR] harmony cases. The rule in (q) is in the same spirit as (b) in deleting a mid-vowel – (q) is only a prosodic representation of what is a segmental representation in (b).

The rule in (r) is meant to illustrate vowel doubling – I prefer the non-linear representation to this segmental schema. There are other rules which have strictly been represented non-linearly, but which because of space cannot be repeated here – e.g., onset formation, de-onseting, nuclearization, etc. In the next section, where the focus is on constraint analysis, I will limit representations to phonological cases at the stem-stem boundary with emphasis on *[+high][-high] and *[-high][-high] vowel-sequence resolution and to prosodic well-formedness cases.

8. A constraint-based account of partative-based place name formation in Akan

It is clear from section four that prosody (i.e., the syllable) functions both as a unit (i.e., an instantiation) and a level of organization (i.e., regulation) of segmental and/or suprasegmental matters that are significant to speech production and comprehension. This position of it in grammar, therefore, means that it has the responsibility to ensure that there is a neat compromise between requirements at the two major designated levels of language computation, and that none of the two major projections – i.e., the underlying and surface levels of representation – has its segmental units and requirements so severely affected in ways that violate their core values and primary functioning as mentioned above. In fact, much of (Akan) phonology is on the prosodic plane, and it is quite fascinating to watch, in the current study, how prosody (i.e., the syllable) as a unit and a level of organization functions to obtain a meaningful articulation-comprehension balance in speech production (i.e., in partative-based place-name formations). The concurrent demands from prosody, the phonotactics (as guided by sonority and markedness conditions), and the strive to preserve contrast in the formation of partative-based place-names makes the Optimality Theory a useful theory for the current study. Also, variations between outputs and inputs as well as their correspondences are not unmotivated. This paper aims to establish such motivations; and it is more for this reason that Optimality theory (henceforth OT) (Prince and Smolensky 1993) – i.e., a constraint-based approach – is the theory of choice in this section. OT is the only phonological theory with the endowment for discovering the motivations (i.e., constraints) and the priority ranking of such for which reason output forms would be required to correspond with and/or diverge from their input forms.

OT as a theory of constraints views output forms (i.e., performance units) as not always truthful in their properties to their inputs. Therefore, it is a requirement of the theory that output forms are evaluated in their wellformedness against a language-specific ranking of violable, universal constraints. That is, constraints are the requirements of language processing – that is, the (grammatical) events that must be avoided and/or permitted in language processing in general. There are two sets of constraints which interact –i.e., are ranked – language-specifically, namely faithfulness constraints, and markedness constraints. Faithfulness constraints promote input-output correspondence on some phonological situation, and markedness constraints are the requirements that act to the contrary. So, in effect, constraints on wellformedness are in conflict. Therefore, while all human languages employ constraints (hence the notion of constraints being universal), each language resolves this persistent universal-constraints conflict in a manner convenient to that language by ranking them – that is, by prioritizing/ranking them from the most-preferred constraint or grammatical requirement, down to the least-preferred constraint or grammatical requirement. In other words, grammatically, each constraint or grammatical requirement must be ranked against each other, but in a language-specific manner. Constraints which output forms respect with some semantic cost incurred are markedness constraints. Constraints which output forms respect without semantic cost incurred are faithfulness constraints. The formation of partative-based place-names in Akan reveals a conflict between faithfulness and markedness constraints. The question is, what is the priority ranking of these constraints in Akan grammar. What (or how much of) formal variation of an output form from its input form is semantically less costly in the formation of partative-based place-names?

Modelling the constraints for vowel sequence resolution and other vowel processes in the formation of place names

A series of markedness-based constraints (i.e., in a non-OT usage of the term 'markedness') interact to resolve impermissible vowel sequences at the stem-stem boundary in place-name formation in Akan. Three interacting markedness requirements/constraints are identifiable from the place-name data. They are functional markedness, phonetic markedness and phonological markedness. Below are their definitions.

(40)

(a) Functional markedness: Root vowels and affixal vowels are treated differently by Akan grammar for which reason it has become necessary to specify a vowel for its functional (i.e., morphological/distributive) information as either a root-vowel or an affixal-vowel. The term [±ROOT] is used here as cover for these two functions; a root-vowel will be specified as [+ROOT] (henceforth, [+RT]) with an affixal-vowel being specified as [-ROOT] (henceforth [-RT]). Functional markedness treats a root-vowel as more marked than an affixal-vowel, and therefore more likely to be preserved over the latter. The ranking, **[+RT] >> [-RT]**, therefore, holds in this case, such that an impermissible vowel sequence will be resolved accordingly.

(b) Phonetic markedness: This markedness is sonority-based. A more sonorous vowel unit is considered more marked than a less sonorous vowel unit, and the sonority scale [+lo(w)] >> [-hi(gh), -lo(w)] >> [+hi(gh)], therefore, is a very significant condition for phonetic markedness. Akan grammar works to preserve a more sonorous unit over a less sonorous unit in a vowel sequence scenario. We can merge information from the sonority-scale (i.e., showing vowel sequence preference) with the ranking outlined under functional markedness to derive more specific vowels as follows:

([**+low**]/+RT >> [**+low**]/-RT (example 4) >>
([**-hi/-lo**]/+RT >> [**-high/-low**]/-RT]) (example 32f-j) >>
([**+high**]/+RT >> [**+high**]/-RT]) (e.g., **dzi** 'eat' + **ɪnam** 'meat'
= **edzinam** 'fork (cutlery)', Fante)

On the one front (i.e., phonetic/sonority plane) a low-vowel is favored over a mid-vowel, and a mid-vowel over a high vowel in a vowel sequence. As shown above, the functions of vowels are only considered when the vowels in sequence are equal in terms of their sonority; Akan grammar works to preserve a root-vowel over an affixal-vowel in this instance.

(c) Phonological markedness: Here, I make a distinction between a contrastive vowel (i.e., a lexically-significant vowel) and a non-contrastive vowel (i.e., a non-lexically significant vowel). In an impermissible vowel-sequence resolution which requires that a vowel be deleted, a contrastive vowel for the fact that it is not predictable cannot be deleted, but a non-contrastive vowel by virtue of its predictability can. There is evidence in the place-name data for contrastive (i.e., lexically-significant) and non-contrastive root and affixal vowels. We observed the following cases with respect to contrast or the absence of it: an affixal vowel which is lexically-significant is retained: [o] is retained in **odumasɪ**. An affixal-vowel which is not lexically-significant is deleted: [o] deletes in **odʑama-asɪ → [dʑamaasɪ]**. A root-vowel which is not lexically-significant (i.e., predictable) is deleted: the first [ɪ] deletes in **tɕɥɪapɪasɪ → [tɕɥapɪasɪ]**; /ɪ/ deletes in **aɕɥɪrɪ-asɪ → aɕɥrɪ-asɪ → [a.ɕɥra.a.sɪ]**; /u/ deletes from **mu** "inside" in partative-based place-names it is associated with. A root vowel which is lexically-significant is highly retained. The above cases suggest that both root and affixal vowels must be specified for their lexical significance. The term [±LEXICAL] (henceforth, [+LEX]) will be used for this purpose. We can incorporate the lexical information of a vowel into the representations in (40b) above to derive what is in (41) below:

(41)
([+low]/+RT/**+LEX** > *[+low]/+RT/**-LEX**) >> (*[+low]/-RT/**+LEX** > [+low]/-RT/**-LEX**)
>>
([-hi/-lo]/+RT/**+LEX** >*[-hi/-lo]/+RT/**-LEX**) >> (*[-hi/-lo]/-RT]/**+LEX** > [-hi/-lo]/-RT]/**-LEX**)

>>
([+high]/+RT/**+LEX** > *[+high]/+RT/**-LEX**) >> (*[+high]/-RT]/**+LEX** > *[+high]/-RT]/**-LEX**)

Representations with the asterisk do not feature in vowel sequences at the stem-stem boundary in the place-name data under consideration; some of them appear in other domains by themselves (and not even in a sequence). Therefore, the representations can be reduced relevantly for vowel-sequences at the stem-stem boundary as in (42). That is, these are the vowel types known to occur in a sequence at the stem-stem boundary in the place-name data under consideration.

(42)
[+low]/+RT/**+LEX**; [+low]/-RT/**-LEX**; [-hi/-lo]/+RT/**+LEX**; [-hi/-lo]/-RT]/**-LEX**; [+high]/+RT/**+LEX**

In Table (7) are their possible combinations; root-vowels are V_1 with affixal-vowels as V_2 in the present study. There is no evidence of the combination in (f) (hence the asterisk) in the current study, but if there were I would suppose that they would behave just like (e). The argument is that Akan grammar is very sensitive to these inherent and functional properties of vowels, and that the impermissible, *[+high][-high] and *[-high][-high] vowel-sequences are resolved partly guided by these conditions.

Table 7. *Conditions for a vowel's deletion in a VV sequence*

	V_1		V_2	Comments
a.	[+low] /+RT /**+LEX**	>>	[+low] /-RT /**-LEX**	Here, V_1 and V_2 are on the same rank in terms of their sonority, [+low]; V_1 is preserved over V_2 because V_1 is a root-vowel and lexically-significant. Therefore, V_2 deletes, V_1 is retained.
b.	[+low] /+RT /**+LEX**	>>	[-hi/-lo] /-RT] /**-LEX**	Here, V_1 is a low-vowel and V_2, a mid-vowel; V_1 ([+low]) has both the functional and sonority advantage over V1 ([-high/-low]). Therefore, V_1 is retained, V_2 deletes.
c.	[-hi/-lo]/ +RT/ **+LEX**	<<	[+low] /-RT /**-LEX**	Here, V_1 is a mid-vowel followed by a low vowel as V_2. V_1 has the functional advantage over V_2 for being a root vowel. The low vowel also has the sonority advantage over the mid vowel. Now, the two have to be weighed to determine whether interchanging them will result in meaning difference – i.e., whether the mid is significantly lexical such that it cannot be displaced by the low vowel. It happens that here the mid vowel can be substituted with the low vowel without affecting meaning. This combines with sonority to make the low vowel the more preferable vocalic segment to preserve in this case. This accounts for the reversive ranking of the two vowels (i.e., << as opposed to >> for the first two vowel sequences).

d.	[-hi/-lo] /+RT /**+LEX**	>>	[-hi/-lo] /-RT] /**-LEX**	Here is a sequence of mid vowels. They are the same in terms of their sonority. V_1 is the root and lexically-significant one. All the conditions are in favor of V_1 over V_2. Therefore, V_2 is the target for deletion with V_1 being retained.
e.	[+high] /+RT /**+LEX**	*<<	[+low] /-RT /**-LEX**	Here, the vowel sequence is a high vowel as V_1, followed by a low vowel as V_2. The retention of the affixal-contrastive low is much more preferred over the retention of the root-contrastive high. The occurrence here with that in (c) suggests that the sonority scale has a more basic role in what must delete; and that possibly function becomes an important factor when the vowels in the sequences rank the same in sonority (as pertained in (a) and in (d)). However, the root high vowel in domains where it is lexically-significant does not simply give in to the low vowel; it undergoes glide/onset formation to insulate itself from deletion by the low vowel. Therefore, **[+low]/-RT/-LEX** does not outrank **[+high]/+RT/+LEX** in this scenario; the two requirements need not be crucially ranked as both must be retained in an output.
*f.	[+high] /+RT /**+LEX**	<<??	[-hi/-lo] /-RT] /**-LEX**	No evidence of this in this study.

Now from the table these are the possible faithfulness constraints and the hierarchy they must assume in the resolution of the impermissible *[+high][-high] and *[-high][-high] vowel sequence. Impermissible: *[+high][-high] and *[-high][-high] are therefore our markedness constraints among others as shown in (44).

(43) **<u>Faithfulness constraints</u>**

(a) **IDENT-IO-[+low]/+RT/+LEX**: A lexically-significant, root low-vowel of an input must be preserved in an output. (Henceforth: **[+low/+RT/+LEX]**)

(b) **IDENT-IO-[+low]/-RT/-LEX**: A low-vowel of an (affixal) input must be preserved in an output. (Henceforth: **[+low/-RT/-LEX]**)

(c) **IDENT-IO-[-hi/-lo]/+RT/+LEX**: A lexically-significant, root mid-vowel of an input must be preserved in an output. (Henceforth: **[-hi/-lo/+RT/+LEX]**)

(d) **IDENT-IO-[-hi/-lo]/-RT]/-LEX:**A mid-vowel of an (affixal) input must be preserved in an output. (Henceforth: **[-hi/-lo/-RT/-LEX]**)

(e) **IDENT-IO-[+high]/+RT/+LEX:** A lexically-significant, root high-vowel of an input must be preserved in an output. (Henceforth: **[+high/+RT/+LEX]**)

(44) **<u>Markedness constraints</u>**

***[-hi][-hi]:** A non-high and non-high vowel sequence must be avoided.

***[+hi][-hi]:** A high and non-high vowel sequence must be avoided. Where both high and non-high (either a low or mid vowel) are to be retained, the high vowel instigates glide/onset formation to insulate itself – i.e., to counter the impact of the strength of the non-high vowel's sonority.

***x≤3ơ:** A partative-based place-name output (i.e., x) must not be less than or equal to three syllables.

Ranking of faithfulness constraints on vowels:

Below is a reading of the ranking argument:

(45) **[+low/+RT/+LEX] >> [+low/-RT/-LEX], [+high/+RT/+LEX] >> [-hi/-lo/+RT/+LEX] >> [-hi/-lo/-RT/-LEX]**

In avoiding the vowel sequences, *[+high][-high] and *[-high][-high] through deletion, a root lexical low will be preserved over an affix low vowel; an affix low vowel and a root lexical high will both be retained (and will avoid violation of the impermissible *[+high][-high] sequence through glide/onset formation); an affix low vowel and root lexical high will be preserved over a mid-vowel; in a sequence of mid-vowels, a root lexical mid-vowel will be preserved over an affix mid-vowel.

Interaction of faithfulness and markedness constraints

A careful study of the data shows that the ***[+hi][-hi]** constraint does not interact with the constraints, namely [**+low/-RT/-LEX], [+high/+RT/+LEX]** and ***x≤3ơ** as displayed in (46) in the same manner as the constraint ***[-hi][-hi]** does as shown in (47). This need for two different ranking-arguments, one for when the vowel-sequence is [+hi][-hi] and the other for when it is [-hi][-hi] is supported by the constraint evaluations from (Tabeau 1) to (Tabeau 6).

(46) ***[+hi][-hi]**, [**+low/-RT/-LEX], [+high/+RT/+LEX], *x≤3ơ >> DEP**

(47) ***[-hi][-hi], [+low/+RT/+LEX] >> [+low/-RT/-LEX], [+high/+RT/+LEX] >> *x≤3ơ >> [-hi/-lo/+RT/+LEX] >> [-hi/-lo/-RT/-LEX]**

In (Tabeau 1), I illustrate constraint-ranking in (46) with the place-name pronounced as (Tabeau 1-ii) **bɪsɪjasɪ**. That is, the candidate with a glide-onset (i.e., [j]) inserted between /ɪ/ and /a/ becomes optimal; glide-onset formation allows this candidate to respect every undominated constraint (i.e., ***[+hi][-hi]**, [**+low/-RT/-LEX], [+high/+RT/+LEX], *x≤3ơ**) whiles violating **DEP**, a least-ranked constraint.

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Tableau 1. (55) ***[+hi][-hi], [+low/-RT/-LEX], [+high/+RT/+LEX], *x≤3ơ >> DEP**

Input: / bɪsɪ-asɪ / "beneath the cola tree"	***[+hi][-hi]**	**[+low/-RT/-LEX]**	**[+high/+RT/+LEX]**	***x≤3ơ**	**DEP**
(i) **bɪ.sɪ-a.sɪ**	*				
☞ (ii) **bɪ.sɪ.ja.sɪ**					*
(iii) **bɪ.sɪ.-Øsɪ**		*		*	
(iv) **bɪ.sØ-a.sɪ**			*	*	

From (Tabeau 2) to (Tabeau 6) are the Tableaux in support of the ranking argument in (47).

Tableau 2. (56) ***[-hi][-hi], [+low/+RT/+LEX] >> [+low/-RT/-LEX]**

Input: ɲankʊma-asɪ	***[-hi][-hi]**	**[+low/+RT/+LEX]**	**x≤3ơ**	**[+low/-RT/-LEX]**
☞(i) **ɲaŋ.kʊ.ma-Øsɪ**				*
(ii) **ɲaŋ.kʊ.mØ-a.sɪ**		*!		
(iii) **ɲaŋ.kʊ.ma-asɪ**	*!			
(iv) **ɲaŋ.kʊ.mØ-Øsɪ**		*!		*
(v) **ɲaŋ.kʊ.sɪ**			*!	

Tableau 3. (57) ***[-hi][-hi], [+low/-RT/-LEX] >> [-hi/-lo/+RT/+LEX]**

/tope-asɪ/		***[-hi][-hi]**	**[+low/-RT/-LEX]**	**x≤3ơ**	**[-hi/-lo/+RT/+LEX]**
Segmental representation	Prosodic representation				
a. **to.pe.a.sɪ**	CV.CV.V.CV	*!			
b. **to.pa.a.sɪ**	CV.CV.V.CV	*!			*
☞c. **to.pa:.sɪ**	$CV.CV_1.V_1.CV$				*
d. **to.pO.Osɪ**	CV.C.CV		*	*	*

Tableau 4. (58) ***[-hi][-hi], [-hi/-lo/+RT/+LEX] >> [-hi/-lo/-RT/-LEX]**

Input: /asuo-em(u)/ ‘within/surrounded by water’	***[-hi][-hi]**	**[-hi/-lo/+RT/+LEX]**	**x≤3ơ**	**[-hi/-lo/-RT/-LEX]**
(i) **æ.su.o-e.m**	*!			
☞ (ii) **æ.su.o-Øm**				*
(iii) **æ.su.Ø-e.m**		*!		
(iv) **æ.su.Ø-Øm**		*	*	*

Tableau 5. (59) ***[-hi][-hi], [+low/+RT/+LEX] >> [-hi/-lo/-RT/-LEX]**

Input:/aɲina-em(u)/ ‘within the anyina tree’	***[-hi][-hi]**	**[+low/+RT/+LEX]**	**x≤3ơ**	**[-hi/-lo/-RT/-LEX]**
(i) **æ.ɲi.na.-e.m**	*!			
☞ (ii) **æ.ɲi.na.-Øm**				*
(iii) **æ.ɲi.nØ-e.m**		*!		
(iv) **æ.ɲi.n.Ø-Øm**		*!		*
(v) **æ.ɲɪ.m**			*!	

Tableau 6. (60) ***[-hi][-hi], [+low/-RT/-LEX], *x≤3ơ >> [-hi/-lo/+RT/+LEX]**

Input: /dompo-asɪ/ “beneath dompo tree”	***[-hi][-hi]**	**[+low/-RT/-LEX]**	***x≤3ơ**	**[-hi/-lo/+RT/+LEX]**
(i) **dom.po.-a.sɪ**	*!			
☞ (ii) **dom.p^wa.:.sɪ** **CVC.CV.V.CV**				*
(iii) **dom.pØ-a.sɪ**			*!	*
(iv) **dom.po.-Øsɪ**		*	*	

In (Tabeau 2), **[+low/+RT/+LEX]** outranks **[+low/-RT/-LEX]** and does so with ***[-hi][-hi]** and **x≤3ơ.** In (Tabeau 3), **[+low/-RT/-LEX]** (with ***[-hi][-hi]** and **x≤3ơ**) outranks **[-hi/-**

lo/+RT/+LEX] – with the preferred candidate being **to.pa.:.sɪ** ($CV.CV_1.V_1.CV$) with [a]-doubling to escape violation of the undominated ***[-hi][-hi]** constraint. In (Tabeau 4) there is evidence of **[-hi/-lo/+RT/+LEX]** domination of **[-hi/-lo/-RT/-LEX]** with (ii) æ**suo-Ø̲m** **[æsuom]** as the optimal candidate. (Tabeau 5) displays the constraint, **[+low/+RT/+LEX]** and **x≤3ʊ** domination of **[-hi/-lo/-RT/-LEX]** – a root low-vowel is preferred over an affixal mid-vowel in the bid to prevent the non-high-non-high vowel-sequence necessary to respect the undominated *[-hi][-hi] constraint; and (ii) **aɲina-Ø̲m** is the preferred candidate in this case. In (Tabeau 6), the constraints, ***[-hi][-hi], [+low/-RT/-LEX], *x≤3ʊ** and **[-hi/-lo/+RT/+LEX]** and in evaluation and the prosodic constraint, ***x≤3ʊ,** is so vital in selecting the winning candidate. That is, with both (ii) **dom.pʷa.:.sɪ** and (iii) **dom.pØ̲-a.sɪ** violating the lowest-ranked **[-hi/-lo/+RT/+LEX]** constraint, it is on the basis of ***x≤3ʊ** that the optimal candidate is selected. The ***[+hi][-hi]** constraint as we observed in (Tabeau 1) is devoid of these crucial rankings that characterize ***[-hi][-hi]** and the rest of the constraints.

9. Conclusion

This paper has focused on establishing the segmental and prosodic processes and constraints on the formation of partative-based place-names in Akan. A very prominent segmental structure that the current study has largely been devoted to is vowel-sequence at the stem-stem boundary in the formation of partative-based place-names, a V1 belonging to the root of the first stem and a V2 which is an affix (i.e., prefix) of the second stem of the compounding. The factors identified as responsible for observed segmental and prosodic alterations in partative-based place-name formations are prosodic well-formedness which has been defined as the requirement for four syllables in partative-based place-name outputs, and a requirement for the preservation of marked units over unmarked units in place-name outputs. It was argued that conditions from three types of markedness interact significantly to join stems into place-names. The three were identified as functional, phonetic and phonological markedness. Well-formedness requirements in these three areas significantly dictate how impermissible vowel sequences must be resolved in order to derive a partative-based place-name. Functionally, it was observed that while affixes are at a disadvantage over roots in terms of what to preserve just for contrastive purposes, it is not always so. There are occasions where this preference condition is in violation, when the need to preserve an affix vowel over a root vowel is very crucial for which reason phonotactic ill-formedness is resolved in favor of the affix vowel, such that the root vowel is what deletes. An affix is favored in this manner when its taking over from the root vowel has no semantic and production cost implications. That is, when, semantically, their feature difference is not as would change the basic meaning of the root word in the domain of activity and consequently the meaning of an output; and, structurally, when the substituting affix vowel is higher on the sonority scale (and therefore more marked) than the deleting root vowel. On the prosodic plane also, it is not always that the derivation could keep inputs to the four required syllables on the surface. There are occasions where the segmental properties available at the input level can simply not be manipulated to satisfy this well-formedness requirement in this domain of Akan phonology.

Segmentally, non-low vowels and consonants cannot be doubled for prosodic purposes, only a low vowel can – and the low vowel is more sonorous, and more marked, than non-low vowels. That is, Akan grammar in the current data works to preserve marked items over their unmarked counterparts such that, for example, a predictable root or affix vowel (unmarked) will be deleted over non-predictable/contrastive ones. Also, significant root nucleuses and syllables will be preserved over non-contrastive prosodic points of either root words or of affixes. The low vowel (which is more marked and also more sonorous) is preserved over non-low vowels (which is not as the low vowel). for which reason a unit belong in the latter category will be deleted over a unit that belongs in the former category. For mid-vowels, this pressure has come unresisted, and they have always been deleted except when for prosodic purposes their syllables and nucleuses must be preserved. For root high vowels, this threat from the most sonorous (i.e., marked) has not gone unresisted. By employing either their coronality (palatality) and labiality they have always insulated themselves (i.e., as root high vowels) from the low vowel's encroachment and, consequently, their eventual deletion, by erecting either the j-glide or the w-glide to onset the low vowel. By so doing, the root high vowel, followed by the low vowel, is able to successfully escape deletion and respect the impermissible *[+high][-high] constraint simultaneously.

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