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VOWEL DOUBLING BEFORE THE VERBAL UNIT -YE [jɛ] IN ASANTE TWI

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Abstract

This paper offers a derivational account of [jɛ], and establishes the motivation for vowel doubling before [jɛ] in some past and perfect verb stems in Asante Twi. The paper identifies ‘avoidance of an independent high vowel syllable’ as the prosodic condition that motivates the formation of the **VVjɛ** subunit in these verb stems. What begins as an attempt to, optionally, resolve a violation of this prosodic condition at the stem final position results in a violation of it stem-medially. A vowel is doubled to avert the violation of this condition at the stem medial position. Vowel doubling feeds the phonological processes that derive the **jɛ** subunit of these verb stems. There is alternation in verb stems; the forms with **...VVjɛ** ending is one of three different permissible outputs in Asante Twi. A constraint-based account identifies four free ranking constraints as responsible for the alternation in these verb stems. These constraints organize into three subhierarchies that select the three different output forms of a verb stem. Interaction among the four constraints within the three subhierarchies is guided by the ranking schemas: Markedness constraints >> Faithfulness constraints, Faithfulness constraints >> Markedness constraints and Segmental/featural constraints >> Prosodic constraints. The arrangement of these constraints into the first schema selects a verb stem with the **...VVjɛ** ending over the other permissible outputs.¹

Keywords: past, perfect, suffix, doubling, constraints

¹ The Department of Linguistics at Legon assigned me to Professor Florence Abena Dolphyne as my thesis advisor in the year 1999. We had a very good working relationship. I found her to be very approachable, respectful of me and my ideas, and very generous. She was a good advisor for the work I was doing, and I knew that she wanted me to succeed in my studies. I think she went beyond the call of duty for the period I worked with her. She introduced me to the teaching of the Akan (Twi) language to foreign students on this campus, and generously gave me a copy of her Twi book which I used to teach the language to this foreign

1. Introduction

Akan employs two main suffixing strategies in past affirmative and perfect negative sentences. The suffix is a copy of the verb's final segment when the verb is followed by an object or a complement, but is realized as **-ɪ/-i** in the absence of an object or a complement to follow the verb (Dolphyne 1988). In other words, the two suffixing strategies are mutually exclusive in their contexts of application. Dolphyne (1988) identifies **-ye** as another past suffix in the Asante Twi dialect of Akan. She defines **-ye** as an alternative past suffix of **-ɪ/-i** in the Asante dialect of Akan. This means that **-ye**, whenever it is in use, just like **-ɪ/-i**, is never followed by an object or a complement. She observes that **-ye** is always preceded by two identical vowels, but the same is not required before **-ɪ/-i**. The two identical vowels that occur before **-ye** belong to separate syllables in Akan phonology: the first vowel is a nucleus of the verb's final syllable, and the second, a nucleus of an undefined (vocalic) syllable that interrupts the verb and **-ye** sequence. By the current study, the vowel that immediately precedes **-ye** is derived through doubling – that is, by the lengthening of the first of the two identical vowels – hence the use of the term vowel doubling in this paper. Three questions are very important and motivate this study. One, why must **-ye** be preceded by a vowel?² Two, why must a vowel before **-ye** be doubled? Three, is **-ye [jɛ]** indeed an alternative suffix of **-ɪ/-i**? This paper primarily investigates the motivations for the occurrence and the doubling of a vowel before **-ye** in this area of Akan phonology and also refines Dolphyne's (1988) position on **-ye** as an alternative past suffix of **-ɪ/-i** in Asante Twi. Specifically, it pursues a derivational account of the **-ye** unit of the past affirmative and perfect negative verb stem in Akan. It argues that the formation of **-ye** on the past affirmative and perfect negative verb stem in the Asante dialect of Akan

student. She was there for me, and I am very happy to be able to join with the rest of my colleagues in linguistics to honor her with this publication on her 80th birthday.

² A reviewer offered this example to suggest that **-ye** may also be preceded by a consonant: 'Aba **yam-ye**' Aba milled/grinded it? The correct Asante version of this sentence is **Aba yamm-ye**. The final consonant of the verb, **yam** 'to grind' is doubled before **-ye [jɛ]**. My position on this is not different from when **[-jɛ]** is preceded by a vowel. In both case, a segment (i.e. a preceding vowel or consonant of **[-jɛ]**) is doubled/lengthened. The doubling in each case delinks **-ɪ** which then becomes **[j]** before **[ɛ]**. That a verb final consonant doubles before **[-jɛ]** falls outside the scope of the current research, that is, considering the title of the current paper.

is necessary to satisfy certain phonotactic (i.e. segment and syllable sequencing) constraints in this dialect of Akan. Same phonotactic constraints motivate vowel doubling.

The rest of the paper is organized as follows. Section two provides the relevant background information on the data from Akan morpho-syntax and phonology. Section three outlines some basic analytical principles from linear and non-linear phonology, and optimality theory. In section four is the analysis: a rule-based and non-linear approach to the problem, and a constraint-based approach to the problem. This section aims to establish the constraints that motivate **-yɛ** formation and vowel doubling before **-yɛ**. Section five is the conclusion.

2. A brief introduction on Akan syntax and phonology

There are two subsections to this section, subsection (2.1) and (2.2). Discussions in subsection (2.1) focus on defining the problem under investigation. In subsection (2.2) is a short introduction to Akan phonology, and an outline of other phonological choices I deem relevant for this study.

2.1 Suffixation on the verb in Akan

The only instance where a verb undergoes suffixation in the Akan tense-aspect system is in the past affirmative and perfect negative sentence construction. The suffix is attached to the affirmative verb to form the past affirmative sentence, but to the negative verb to derive the perfect negative sentence. There are different suffixal units for different morphosyntactic and phonological contexts, and Dolphyne (1988) and Osam (2003) have defined adequately when the different suffixal units are in use in the language.³ Below are some of Dolphyne's (1988) observations on the past affirmative and perfect negative verb stems in Akan:

The Past suffix **-i/-ɪ**: This is the only suffix in the verbal forms. It occurs in the Past Affirmative and Perfect Negative forms of the verb. There are two different

³Osam (2003) calls completive aspect what Dolphyne (1988) has called past tense. The reason of Osam's (2003) choice of the term completive aspect over Dolphyne's (1988) past tense is beyond the scope of this paper.

realizations of this suffix depending on whether or not the verb is followed by an object or a complement.

(i) Where the verb is not immediately followed by an object or a complement, a Low tone suffix **-i/-ɪ** which agrees with the vowel of the stem in being advanced or unadvanced occurs after the stem. In Asante the suffix has two alternative forms, either the high front vowel **-i/-ɪ**, or **-yɛ**, and in each case the suffix is preceded by a long vowel.) If the stem ends in a vowel, the long vowel is the same quality as that of the final vowel. Where the stem ends in the bilabial nasal **m**, the vowel that occurs before the suffix is a high rounded vowel. Where the stem ends in **n**, the vowel that occurs before the suffix is a high vowel that agrees with the vowel of the stem in lip position.

(ii) Where the verb is immediately followed by an object or a complement, the suffix is realised as a lengthening of the final vowel, if the stem ends in a vowel. If the stem ends in a consonant, the suffix does not occur but its tone is carried by the final consonant. The unified Akan orthography represents this by doubling the final consonant letter. In Asante such a stem may also be pronounced with a high vowel after the final consonant (Dolphyne 1988: 93 – 94).

The suffixal forms are: (a) **-ɪ**, (b) **-i**, (c) **-yɛ** (in Asante, Dolphyne 1988), and (d) a vocalic or consonantal copy of the verb-root's final segment (i.e. last letter lengthening, Ofori 2006). **-ɪ** ([-ATR]) is used when the preceding vowel is [-ATR]; Akan operates [+ATR] harmony so there is a change of **-ɪ** to **[-i]** after a [+ATR] vowel. In (1), (2) and (3) below, the past affirmative and perfect negative verb stems are not followed by an object or an adverbial noun and the first three forms (**-ɪ**, **-i**, and **-yɛ**) are in use there. The suffix is realized as a copy of a verb-root's final (vocalic or consonantal) segment when the verb is followed by an object or an adverbial noun. The abbreviations: As., Ak. and Fa. stand for Asante Twi, Akuapem Twi and Fante, respectively. A dash '-' indicates a morpheme boundary.

The suffix without a succeeding object or noun adverb

(1) The use of **-ɪ**

(a) Past affirmative:

(i) **ɔ̃-sà-ɪ** 'She/he fetched (it).' (As/Ak/Fa)

(ii) **ɔ̃-sàà-ɪ** 'She/he fetched (it).' (As.)

In a section of the Asante Twi data, Dolphyne (1988) inserts **ɛ** in bracket after **ɪ** (the suffixal vowel). Below are such cases and pages of her book they can be found.

- | | | |
|------|-------------------------------|---|
| (5) | Asante | English |
| (5a) | mìtùì(è). | ‘I dug it up.’ (Dolphyne 1988: 88) |
| (5b) | wútùì(è). | ‘You dug it up.’ (Dolphyne 1988: 89) |
| (5c) | òtùì(è). | ‘He dug it up.’ (Dolphyne 1988: 89) |
| (5d) | ètùì(è). | ‘It was uprooted.’ (It came off.) (Dolphyne 1988: 90) |
| (5e) | yètùì(è). | ‘We dug it up.’ (Dolphyne 1988: 90, 91) |
| (5f) | mútùì(è). | ‘You (pl.) dug it up.’ (Dolphyne 1988: 91) |
| (5g) | Kòfí nà èkɔ̀ì(è). | ‘It is Kofi who went.’ (Dolphyne 1988: 90) |
| (5h) | ̀nkòdàà nó nà èhúì(è). | ‘It is the children who saw it.’ (Dolphyne 1988: 90) |

This bracketed representation of the **ɛ** segment after **ɪ** (i.e. the past suffix vowel) is relevant to the current study. This mode of representation suggests the optionality of the **ɛ** segment where it occurs. My analytical stance, in this paper, is that **ɛ** is an optional prosodic unit and that **-ye [jɛ]** as in (3) above is derived from the **ɪ(ɛ)** vowel sequence.

2.2 A short description of Akan sounds and prosodic units

There are nine vowel phonemes and eighteen consonantal phonemes in Akan, a conclusion based on Dolphyne (1988), page 7 and 48 respectively. Akan has also five nasal vowel phonemes: **ĩ, ĩ̃, ã, õ, ù** (Dolphyne 1988: 3). Phonetically, there are ten oral vowel sounds in Akan. Akan operates advanced tongue root harmony and for this reason the low (unadvanced) vowel **/a/** changes to **[æ]** (advanced) to harmonize with a succeeding vowel which is advanced ([+ATR]) in the Twi dialects of Akan (e.g. **/adi/** ‘have eaten’ is pronounced as **[ædi]**). The unadvanced vowels, **/ɪ, ʊ, ɛ, ɔ, a/**, in the context of [+ATR] harmony, are realized phonetically as **[i, u, e, o, æ]** respectively. In the Fante dialect of Akan, the low unadvanced vowel, **/a/**, changes to **[e]** to agree with a succeeding vowel in the feature [+ATR]. Dolphyne (1988: 29) represents thirty four consonant sounds in Akan. For the current study, we will only need the sounds in the table.

(6) The feature matrix for selected sounds in Akan

	i	ɪ	u	ʊ	e	ɛ	o	ɔ	a	æ	j	m
Syllabic	+	+	+	+	+	+	+	+	+	+	-	+/-
Low					-	-	-	-	+	+		
High	+	+	+	+	-	-	-	-	-	-		
ATR	+	-	+	-	+	-	+	-	-	+		
Cor/Pal	✓	✓			✓	✓					✓	
Lab			✓	✓			✓	✓				✓

Traditionally, the features \pm high, \pm low, \pm round/ \pm back, \pm advanced are what are very often in use in works on vowel description in Akan. I have left out \pm round/ \pm back and have employed \pm syllabic, coronal (palatal) and labial to help define phonological processes involving vowels, consonants and prosody (i.e. the syllable) simultaneously. The mark ✓ has been used to indicate the presence of a privative feature; binary features are represented in their usual positive/negative values.

The feature syllabic is needed to represent a change in the prosodic status of a segment. The feature round is considered a dependent of the feature labial in the current study following Sagey (1986: 137 – 145), McCarthy (1988: 103-104) and Lahiri and Evers (1991: 87). This position is justified by the fact that, in Akan, a word-final non-round high vowel becomes round whenever there is the need for this high vowel to harmonize with a consonant in labiality in a phonological environment. The use of the feature labial helps to put the sounds u, ʊ, o, ɔ and m in a natural class, and, therefore, provides justification for consonant-vowel labial harmony as described above. I treat front vowels (more important to the current work, i and ɪ) as coronal (palatal) following Hume (1992) and Clements and Hume (1995). This puts the sounds i, ɪ and j in a natural class of their own in the current work, and helps to explain why a high front vowel reassociates with an onset-slot of a succeeding syllable as j.

Akan has two contrastive tones: high / ˊ / and low / ˋ / as in the words, dá ‘day’ and dà ‘never’. There are three major syllable types: CV, V and C (i.e. a syllabic consonant). A sequence of vowels or consonants belong to separate syllables in Akan. The sound sequence VC belong to different syllables, the C is syllabic with its own contrastive tone and never a coda. There is never a C.V syllable sequence in Akan. A C.V syllable sequence is reanalyzed as CV, and where there is need to preserve the sequence, a high front vowel is inserted after C to derive CV.V.

3. Some analytical principles

A derivational account of **-ye [jɛ]** and the second of the two identical vowels that precede it (i.e. [jɛ]) demands “two designated levels of representation, [an] underlying form and [a] surface form ... [with possibly] a number of non-designated levels intermediate between the underlying and surface levels [especially within linear and nonlinear generative phonology]. [Such] non-designated levels are the result of sequential application of phonological rules, or sequential application of phonological rules” (McCarthy 2007: 101). Phonological rules “are the devices employed by the phonological theory to account for the relationship between representations at different levels” (Goldsmith 1996: 2).

The phonological changes that apply to derive past affirmative and perfect negative verb stems in the Asante dialect of Akan show that “nonlinear relations obtain at the intersection of segmental and prosodic structure” (Kenstowicz 1994: 311) in the past affirmative and perfect negative data. That is, the phonological processes that apply to derive these verb stems give credence to the cross-linguistic observation that “the segmental and prosodic aspects of phonological representations are subject to distinct organizing principles and [must] be kept formally distinct” (Harris 2007: 119 – 120, a viewpoint advocated earlier by Goldsmith 1976, Halle and Vergnaud 1982). “The syllable plays an important role as a prosodic constituent ...” (Blevins 1995: 206). “[It] has a central role in phonological theory as a constituent that represents phonologically significant groupings of segments” (Zec 2007: 161). The syllable plays a very important role in both a nonlinear and a constraint-based analysis of alterations in the current data. The following positions on the syllable are well supported in the Akan data:

First, the syllable is a natural domain for the statement of [some] phonotactic constraints. Second, phonological rules are ... more simply and insightfully expressed [when we] explicitly refer to the syllable. Finally, [certain] phonological processes are best interpreted as methods to ensure that the string of phonological segments is parsable into syllables (Kenstowicz 1994: 250).

It holds also that there is not always a one-to-one relation between syllabic positions and features or segments (van der Hulst and van de Weijer 1996) and, segments may be either inserted, deleted, doubled or reassociated in certain phonological domains just to

achieve prosodic and phonotactic well-formedness. These positions above are best articulated within the autosegmental phonology framework.

The ultimate goal of this paper is to establish the constraints – i.e. the well-formedness constraints – that underlie and therefore motivate both segmental and prosodic alterations within the past affirmative and perfect negative verb stems, particularly, the constraints that motivate vowel doubling in these verb stems. According to Fromkin (2000:690) “... constraints function like filters that exclude or prohibit specific types of linguistic representations that fail to satisfy the requirement imposed by the constraint” (Fromkin 2000: 690). Within optimality theory, however, a constraint is defined as “a structural requirement that may be either satisfied or violated by an output. A form satisfies a constraint if it fully meets the structural requirement, while any form not meeting this requirement is said to violate it” (Kager 1999: 9). A constraint exists as either a markedness constraint or a faithfulness constraint. Markedness constraints “require that output forms meet some criterion of structural well-formedness ... [and] never take into account elements in the input” (Kager 1999: 9-10). “Faithfulness constraints require that outputs preserve the properties of their basic (lexical) forms, requiring some kind of similarity between the output and its input [; that is, faithfulness constraints] preserve lexical contrasts ... [and also] restrict the shape variability of lexical items (Kager 1999: 10). “An output is ‘optimal’ when it incurs the least serious violation of a set of [faithfulness and markedness] constraints, taking into account their hierarchical ranking”. [Constraints] “conflicts are resolved through domination: ... the higher-ranked of a pair of conflicting constraints takes precedence over the lower-ranked one” (Kager 1999: 13).

4. Analysis

4.1 Introduction

This section aims to establish the phonotactic and prosodic well-formedness conditions that underlie and, therefore, motivate the phonological processes that apply within the past affirmative and perfect negative verb stems. Akan operates [+ATR] harmony. My position, therefore, is that {-**I**} is the underlying suffix for the past affirmative and perfect negative sentences. {-**I**} is realized as [-**i**] after a [+ATR] vowel due to [+ATR] harmony. The verbal unit, -**yε** [**jε**], is phonetic, not underlying. **yε** [**jε**] is derived from the vowel sequence **ie**. The vowel **i** of the **ie** sequence is the underlying suffix for the past affirmative and perfect negative sentences. The **ε** of the **ie** sequence is an optional segment that finds its way after the **i** morphemic segment in stretched speech. This is not the first

work to characterize the **ɛ** segment that succeeds **ɪ** as optional. The optional, non-contrastive status of **ɛ** is implied in Dolphyne's (1988) representation of the segment. She characteristically encloses **ɛ** in bracket after **ɪ** and, in linguistics, this suggests the optionality (and, therefore, the non-contrastiveness) of the segment concerned. If there is a gap in Dolphyne's (1988) account of alternations in the past affirmative and perfect negative stems, it is the fact that she fails to explore any phonological connection between the **ɪ(ɛ)** and the **-yɛ [jɛ]** subunits of the past affirmative and perfect negative verb stems, and also fails to account for vowel doubling (i.e. the two identical vowels) before **-yɛ [jɛ]**.

The claim of this paper is that the **ɪ(ɛ)** and **jɛ** subunits of past affirmative and perfect negative verb stems are not unrelated. Phonologically, **-yɛ [jɛ]** is derived from the **ɪ(ɛ)** vowel sequence. The phonetic realization of the **ɪ(ɛ)** vowel sequence as **[jɛ]** is triggered by vowel doubling and, therefore, explains why **jɛ** must always be preceded by the two identical vowels. Vowel doubling applies to obtain prosodic well-formedness and does so to displace **ɪ**. The **ɪ** vowel which is dissociated from its syllabic anchor through vowel doubling, then reassociates as the onset of the optional **ɛ** vowel to derive **jɛ**, and to achieve phonotactic well-formedness.

4.2 Rule-based linear and non-linear approach

From the above positions, contrastive units of the past affirmative and perfect negative verb stems at the clause final (#) position can be defined as in (7) and (8) respectively.⁴ (*sfx* stands for suffix.)

(7) Past affirmative: **Verb** + **-ɪ_{sfx}#**

(8) Perfect negative: **N-** + **Verb** + **-ɪ_{sfx}#**

Missing from the underlying representations in (7) and (8) are: (i) **ɛ**; (ii) **j**, the onset of **ɛ**; (iii) the extra vowel that comes to precede the **jɛ** sequence (i.e. the extra vowel that is derived through vowel doubling); and (iv) the realization of a CVC verb as CVCV when it is followed by **-ɪ** (the past suffix). From the current study, these units are predictable (i.e. phonetic and non-contrastive) and are introduced into the underlying past affirmative and

⁴ Structurally, Akan has the following verb types: CV (e.g. **ɔ̃** 'eat.transitive', **hɔ̃** 'see', **ɔ̃** 'sleep', **ɔ̃** 'sell'), CVC (e.g. **ɔ̃** 'sell', **pàɔ̃** 'to sew', **dùɔ̃** 'to put out fire'; CVC verbs are realized as CVCV_[+High] before **-ɪ**), CVCV (**bisá** 'ask', **ɔ̃ɔ̃** 'eat.intransitive')

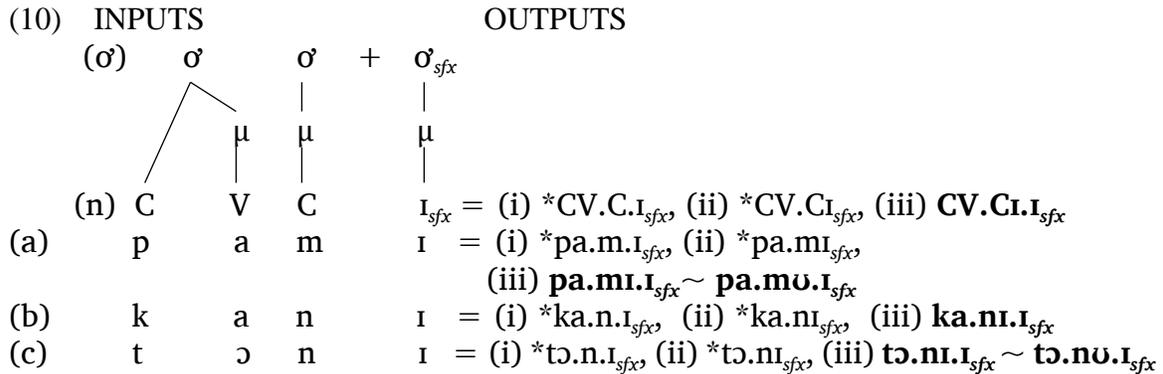
perfect negative verb stems, phonologically, for the purpose of achieving prosodic and phonotactic well-formedness. The goal moving forward is to formulate such well-formedness conditions and to define and illustrate the phonological processes that apply to ensure that particular well-formedness conditions are observed in the past affirmative and perfect negative verb stems. The main phonological processes involved here are: default **ɪ** insertion, prosodic (syllable) augmentation, vowel doubling/lengthening, **ɪ** delinking and reassociation (as either an onset or a nucleus) and **ɛ** insertion.

Default ɪ insertion

The phonological rule that inserts **ɪ**, the default vowel in Akan, applies between a CVC verb root and **-ɪ_{sfx}**. A linear representation of the rule is as given in (9) below.

(9) $\emptyset \rightarrow \mathbf{ɪ} / \mathbf{C} _ . \mathbf{ɪ}_{sfx} \#$

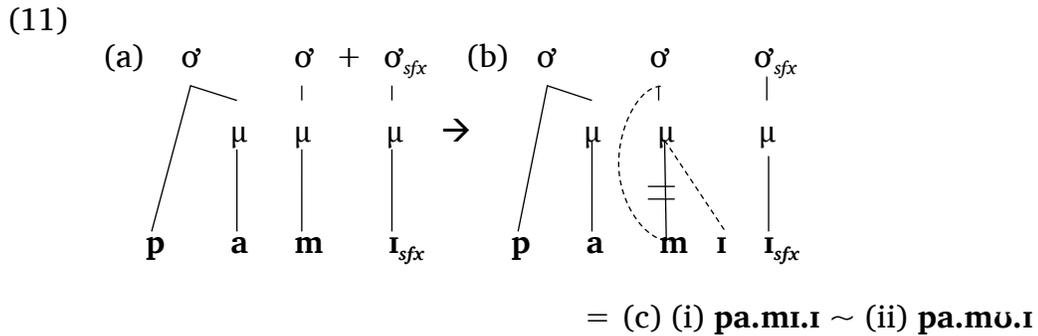
A non-linear formulation of the rule, as in (10), will help express the well-formedness conditions that motivate the **ɪ** insertion rule adequately. The CVC verbs that are represented in the diagram below are: **pàɲɲ** ‘to sew’, **kàɲɲ** ‘to read’ and **tɔ̀ɲɲ** ‘to sell’. These verbs change to become CVCV after the default **ɪ** insertion rule has applied to them. On the right side of the diagram are possible output forms. Illicit output forms are marked with an asterisk, and a dot (.) indicates syllable boundary.



The syllable structure in (10a-i, 10b-i and 10c-i) is *CV.C.ɪ_{sfx}. The suffix (-ɪ) is an independent syllable and it is preceded by a syllabic consonant. The *CV.C.ɪ_{sfx} output forms are ungrammatical because Akan does not permit the C.V syllable sequence. The

syllable sequence in (ii) is an improvement on the one in (i): Here, \mathbf{I}_{sfx} is resyllabified into the preceding syllable as a nucleus – and $\mathbf{C}\#$ the nucleus of the affected syllable is delinked and reassociated as onset – to prevent the C.V syllable sequence, but the effort is still not enough.

The past/perfect suffix must be an independent syllable and the fact that this condition is flouted in (ii) is what makes output forms here ungrammatical. The rule that inserts the default \mathbf{I} segment is therefore necessary for two important reasons. It applies to prevent a C.V syllable sequence and also to guarantee the syllabic independence of the past/perfect suffix. Default \mathbf{I} insertion takes place on the segmental plane, but there is a prosodic readjustment/realignment, as shown in (11) below, to accommodate the new vowel.



The inserted vowel \mathbf{I} obtains the nuclear slot over \mathbf{C} (the syllabic consonant) on grounds of sonority and shows a strong preference for vowels as nucleus over consonants in Akan. From the diagram in (11), \mathbf{I} associates as nucleus and delinks \mathbf{m} in the process; the delinked \mathbf{m} , then reassociates as the onset of its syllable. The inserted \mathbf{I} optionally harmonizes with a preceding consonant or vowel in labiality; the labial nasal (\mathbf{m}) spreads labiality to the inserted vowel (**pa.mi.I#** - i.e. the vowel immediately after \mathbf{m}) to derive **pa.mu.I#** in (11c-ii). The fact that the past/perfect suffix vowel does not enter into labial harmony is the evidence that the CVC to CVCV change of the verb root is not due to a leftward spreading of the past/perfect suffix (i.e. \mathbf{I}). An account in favor of a leftward spreading of the $\mathbf{-I}$ suffix over default \mathbf{I} insertion would produce ***pamou#** as the output form (i.e. when the verb stem is not followed by either an object or a complement). That is, labial harmony will target the past/perfect suffix \mathbf{I} (as opposed to an inserted vowel) to derive the ungrammatical output form, ***pamou#**. The verb stem ***pamou#** is ungrammatical for the fact that the verb stem is clause final or is not followed by an object or a complement.

The fact that *m* and a succeeding vowel (**I**) enter into labial harmony (i.e. without the past/perfect suffix (**I**)) is the justification for their independent status, and is the reason the default **I** insertion account is superior to the leftward spreading of **I** account. The coronal nasal (**n**) is transparent in that it does not obstruct the spread of labiality from a preceding vowel to the inserted vowel when the verb root is **CV**_[lab]**n**, for example: **tɔ.nɪ.I#** becomes **tɔ.nu.I#**.

Prosodic (syllable) augmentation/insertion

There is an optional dispreference of an independent high vowel syllable at the stem-final position in Asante Twi.⁵ This is resolved through empty syllable augmentation/insertion after syllabic **I** (i.e. the past/perfect suffix segment). The licit output forms in (12) below are argued to have been subjected to the optional empty syllable augmentation/insertion rule.

(12)

(a) Past affirmative:

(i) /ɔ-sa-I/ → [ɔ̌-sàà-ì] ‘She/he fetched (it).’

(ii) /ɔ-hu-I/ → [ò-hùù-i] ‘She/he saw (it).’

(b) Perfect negative:

(i) /ɔ-n-sa-I/ → [ɔ̌-ṇ-sàà-ì] ‘She/he has not fetched (it).’

(ii) /ɔ-n-hu-I/ → [ò-nhúù-i] ‘She/he has not seen (it).’

(c) Past affirmative (with -yɛ preceded by two identical vowels)

(i) CV verb root: ɔ̌sààyɛ [ɔ̌-saa-jɛ] ‘She/he fetched (it).’

(ii) CVC verb root: ɔ̌pàmòò-yɛ [ɔ̌-pamuu-jɛ] ‘She/he sewed (it).’

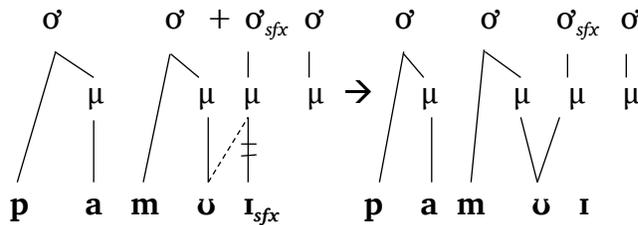
(iii) CVCV verb root: ɔ̌kàsààyɛ [ɔ̌-kasa-jɛ] ‘She/he spoke.’

⁵ The empty syllable insertion rule applies in nouns also in Asante Twi. The rule applies to prevent a final (C)V_[+High] syllabic morpheme. This can also be expressed as the avoidance of a high vowel syllable word-finally. The fact that a high vowel is dispreferred in this domain means that the default **I** insertion rule cannot apply in this domain. The empty syllable is rather filled with the mid-vowel **ɛ**. In nouns, **ɛ** always agrees with its immediate preceding vowel in its values of round and ATR. For example, **asi** ‘under’, **Ghanafu** ‘Ghanaians’, **nsu** ‘water’ are pronounced as **asɛ**, **Ghanafuɔ** and **nsuo** respectively in Asante Twi; **ɛ** is realized as **ɔ** and **o** because of labial (+round) and [+ATR] harmony.

Vowel doubling/lengthening and *ɪ* delinking

The insertion of the empty syllable after syllabic *ɪ* to prevent one prosodic blunder ends up creating another one. The past/perfect suffixal segment *ɪ* (i.e. syllabic *ɪ*) comes to be followed by another syllable. That is, the insertion of an empty syllable puts syllabic *ɪ* at the stem medial position. The language strongly disprefers the independent syllabic-high-vowel at the stem-medial position also. My analytical position is that a high vowel is weak as an independent syllable, intersyllabically. So the problem here is that the segmental content of the past/perfect syllable is under threat of deletion against the requirement, by the grammar, to preserve the past/perfect syllable. The past/perfect syllable cannot be realized or preserved, phonetically, without a segmental content. The language employs vowel doubling (or lengthening) (as obtained in data in 12) to prevent an intersyllabic high syllable (i.e. a high vowel as an independent syllable stem-medially) and, at the same time, to preserve the past/perfect syllable phonetically. In other words, segment lengthening/doubling, as a phonological rule, makes a contrastive prosodic unit (within the past/perfect verb stem) look better on the segmental plane. Below in (15) is an autosegmental representation of vowel doubling.

(15)



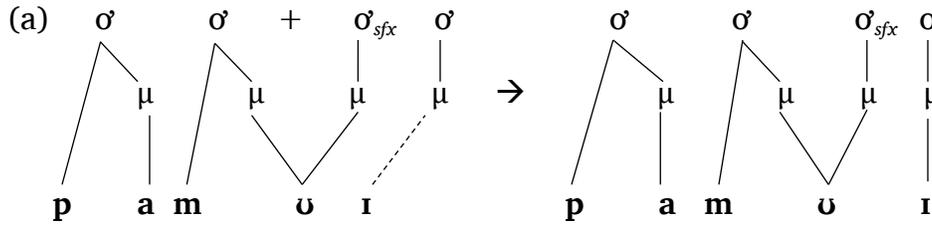
In the above diagram, *ʊ* (a high vowel) lengthens rightwardly to delink *ɪ* (i.e. the segmental content of the past/perfect syllable). The vowel that lengthens to the past/perfect syllable is also a high vowel, but the resultant output does not violate the condition against an independent syllabic high-vowel. What is dispreferred is an independent high vowel syllable, and vowel lengthening does not create one; a doubly associated high vowel does not count as an independent high vowel syllable. Vowel lengthening dissociates *ɪ* (i.e. the past/perfect segmental content) from the past/perfect syllable. The *ɪ*/*i* and *je* units that occur after the two identical vowels (as in 12), from the current research, is not the

past/perfect unit. The extra vowel (i.e. the second of the two identical vowels) before **ɪ**/**ɪ** and **jɛ** as in data (12) and in (15) is, therefore, the ‘new’ (i.e. the emerged/alternative) past/perfect segment.

Delinked **ɪ** reassociation versus **ɛ** insertion

Segmental processes here can be tagged as ‘the competition for a prosodic anchor’. The competition here holds between a rule that seeks to reassociate **ɪ** and another one which applies to insert **ɛ**, and is over the nuclear slot of the empty syllable that was optionally inserted after syllabic **ɪ**. The two rules compete to apply in the same prosodic slot such that the application of one rule removes the phonological context for the application of the other; that is, the two rules are in a bleeding relation. The application of **ɪ** reassociation over **ɛ** insertion is as represented in (16a) and applies to derive the stem variants in (16b and c). Here, the reassociation of **ɪ** as nucleus of the empty syllable bleeds the application of the **ɛ** insertion rule.

(16)



(b) Past affirmative:

(i) /ɔnsaɪ/ → [ɔ̀-**sàà**ɪ] ‘She/he fetched (it).’

(ii) **ɔ̀pámòò**ɪ [ɔ̀-**pam**ɔ̀ɪ] ‘She/he sewed (it).’

(c) Perfect negative

(i) /ɔnsaɪ/ → [ɔ̀**nsáà**ɪ] ‘She/he has not fetched (it).’

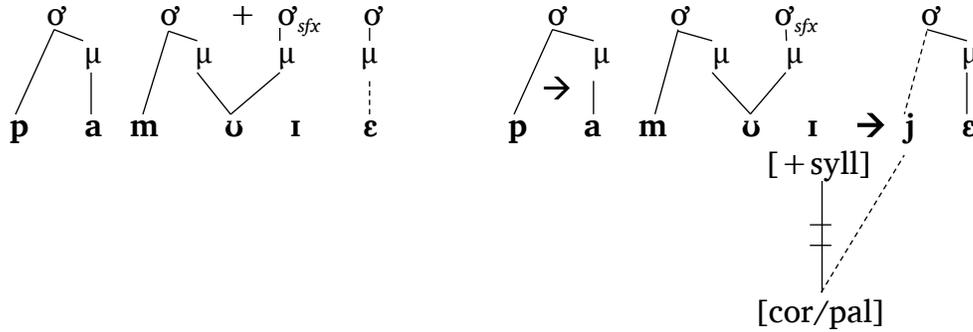
(ii) **ɔ̀mpámòò-ì** [ɔ̀**mpám**òò-ì] ‘She/he has not sewn (it).’

Stem variants consisting of two identical vowels (i.e. vowel doubling) followed by **-ye** [jɛ] as given in (17) below are examples of the inverse application of the two rules: the rule that applies to insert **ɛ** as nucleus of the empty syllable takes precedence over the rule that applies to reassociate **ɪ** to this very prosodic anchor. The rule on **ɛ** insertion bleeds

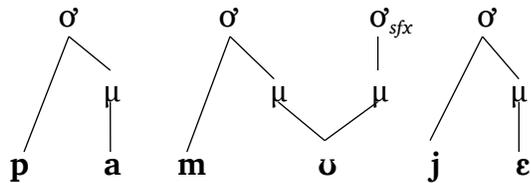
(19)

(a) ϵ insertion: $\emptyset \rightarrow \epsilon$ / [+High] _ #

(b) onset formation: [+syll, cor/pal] \rightarrow [-syll] / V_{αF}.V_{αF}._V_[-Hi]



(c) Final output:



= **pamouje** (*orthographically: pamooye*)

= **mpamouje** (*perfect negative*)

The observations above suggest that some distinctive features are strictly properties of certain prosodic domains. The feature [+syllabic] is strictly a feature for the nuclear slot of the syllable in Akan, by this study. The feature coronal/palatal is ambidextrous, in this regard, for being able to feature at both the nuclear and onset slots of the syllable.

In (20) below are illustrations of the phonological rules that apply to derive the **VVje** subpart of the past affirmative and the perfect negative verb stems in Asante Twi.

(20) Phonological rules that derive the verb stem ending: ...VVjε#

tɔ ‘sell’, sa ‘dance’, pam ‘sew’, tɔn ‘sell’ Rules: ↓ Inputs: →	CV verbs		CVC verbs	
	(i) tɔ ⁺ ɪ #	(ii) sa ⁺ ɪ #	(iii) pam ⁺ ɪ #	(iv) tɔn ⁺ ɪ #
(a) Default ɪ insertion: ∅ → ɪ / C _{-.I_{sfx}} #	N/A	N/A	pa.mi.ɪ ~ pa.mu.ɪ	tɔ.nɪ.ɪ ~ tɔ.nʊ.ɪ
(b) Syllable insertion: ∅ → σ / σ.I ₋ #	tɔ.ɪ.σ #	sa.ɪ.σ #	pa.mi.ɪ.σ ~ pa.mu.ɪ.σ	tɔ.nɪ.ɪ.σ ~ tɔ.nʊ.ɪ.σ
(c) Vowel doubling / lengthening: V → V.V / -.I.ε #	tɔ.ɔ.(ɪ)σ	sa.a.(ɪ)σ	pa.mi.ɪ.(ɪ)σ ~ pa.mu.ɔ.(ɪ).σ	tɔ.nɪ.ɪ.(ɪ).σ ~ tɔ.nʊ.ɔ.(ɪ).σ
(d) ε insertion: ∅ → ε / V.V.(ɪ) ₋] _σ #	tɔ.ɔ.(ɪ)ε	sa.a.(ɪ)ε	pa.mi.ɪ.(ɪ)ε ~ pa.mu.ɔ.(ɪ).ε	tɔ.nɪ.ɪ.(ɪ).ε ~ tɔ.nʊ.ɔ.(ɪ).ε
(e) Onset formation: [+syll,cor/pal] → [-syll] / V_{αF}.V_{αF} = V _[-Hil]	tɔ.ɔ.jε	sa.a.jε	pa.mi.ɪ.jε ~ pa.mu.ɔ.jε	tɔ.nɪ.ɪ.jε tɔ.nʊ.ɔ.jε
Final output	tɔ.ɔ.jε	sa.a.jε	pa.mi.ɪ.jε ~ pa.mu.ɔ.jε	tɔ.nɪ.ɪ.jε ~ tɔ.nʊ.ɔ.jε

The default **ɪ** insertion rule feeds vowel doubling in CVC verb roots, since it is the default vowel which is lengthened in CVC verb roots. Also, syllable augmentation/insertion feeds vowel lengthening or doubling, vowel doubling applies to delink **ɪ**; also syllable augmentation/insertion feeds **ε** insertion, while **ε** insertion feeds the **ɪ** to **j** onset formation. Represented in table (20) are the past affirmative forms of the verb stem. The perfect negative forms are preceded by a homorganic nasal which functions as the negative marker, and are realized as: **ntɔɔje** ‘have not bought (it)’, **nsaaje** ‘have not fetched (it)’, **mpamuje** ~ **mpamuɔje** ‘have not sewn (it)’ and **ntɔnuje** ~ **ntɔnuɔje** ‘have not sold (it)’.

4.3 A constraint-based account of the problem

The following is a constraint-based (optimality theoretic) account of past affirmative and perfect negative verb-stem alternations in Asante Twi. Illustrations are based on output forms in (21) below.⁶

(21) Past affirmative:

Inputs	Outputs							
	Permissible			Impermissible				
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
(a) /sa + -I/	sa.I	sa.a.I	sa.a.jɛ	sa.I.ɛ	sa.a.I.ɛ	sa.ɛ	-	
(b) /hu + -I/ → hu.i	hu.i	hu.u.i	hu.u.j ɛ	hu.i. ɛ	hu.u.i.ɛ	hu.ɛ	-	
(c) /pam + - I/ → pa.mI.I	pa.m I.I~ pa.m ɔ.I	pa.mI. I.I ~ pa.mɔ .ɔ.I	pa.mɔ .ɔ.jɛ	pa.m ɔ.I.ɛ	pa.mɔ. ɔ.I.ɛ	pa. mɔ. ɛ	pa. m.I	pa. mI _{sfx}

Below in (22) and (23) are the faithfulness and markedness constraints that are crucial to the current study and their definitions. Faithfulness and markedness constraints have further been grouped into segmental and prosodic constraints.

Constraints

(22) Faithfulness constraints

(a) **IDENT-IO-[Cor/pal]**: The feature coronal/palatal of a segment must be preserved in an output. The three permissible output forms, for example: (21-i), (21-ii) and (21-iii) **sààjɛ** all respect this faithfulness constraint; candidates in (21-vi) do not. Candidates in (21-vii) and (21-viii) respect this constraint but do not count as optimal outputs in the language, and this is because these forms violate constraints that outrank (22a) like ***C.V** and **sfx** = **ɔ** respectively.

⁶ The forms in the table are in the past affirmative. The perfect negative form of a verb is constructed by prefixing the homorganic nasal, N-, to a past affirmative verb stem.

(b) **DEP- σ** : An output syllable must have its input correspondence. That is, no syllable augmentation/insertion in an output. Two of the three permissible output forms violate this constraint, namely (21-ii) and (21-iii) – these are the candidates that exhibit vowel doubling as a result of syllable augmentation. Permissible candidates in (21-i) do not violate DEP- σ . Impermissible forms in (21-iv, v and vi) all violate this constraint; forms in (21-vii, viii) do not incur a violation here.

(c) **DEP- ϵ** : The output segment ϵ must have input correspondence. Permissible forms in (21-iii) violate this constraint. Impermissible forms from (21-iv) to (21-vi) also violate this constraint. Permissible forms in (21-i) and (21-ii) do not violate it.

(d) **sfx = σ** : The (past and perfect) suffix is a syllable. This constraint is respected by every candidate in (21) except (21-viii) **pa.mi**_{sfx}. Here, the suffixal segment, **i**, and the preceding syllabic consonant (**m**) – i.e. a sequence of two syllables – are joined into a single syllable. The need for syllabic independence of the suffixal morpheme is flouted by this merger.

(23) Markedness constraints

(a) ***CV- [cor/pal]**: Avoidance of a CV before a segment with the feature coronal/palatal (i.e. **i**, **ɪ** and **j**). This constraint works against candidates in (21-i) and (21-iv), but in favor of those in (21-ii) and (21-iii) where a coronal/palatal segment is preceded by two identical vowels.

(b) ***C.V**: Avoid a sequence of a syllabic consonant and a vocalic syllable. This is a constraint against the output form in (21-vii) for example.

(c) *** \mathbf{i} σ #**: Avoid the segment [+syll, cor/pal] as an independent syllable at the stem final position. This constraint militates against forms in (21-i) and (21-ii) – these are permissible output forms in Asante Twi. The constraint favors output forms in (21-iii), i.e. the primary data for this research.

(d) *** σ .**i**. σ #**: Avoid the segment [+syll, cor/pal] as an independent syllable at the stem medial position. The permissible forms in (21-iii) do not violate this constraint because, in autosegmental language, **i** reassociates with a succeeding onset as **j**. Forms in (21-iv) and (21-v) violate this constraint; the segments, **i** and **ɪ** are independent syllables, and are at stem medial position.

Below in (24) and (25) is a regrouping of constraints in (22) and (23) into segmental/featural and prosodic constraints.

(24) **Segmental/featural constraints**

- (a) ***CV- [cor/pal]** : Avoidance of a CV before a segment with the feature coronal/palatal.
- (b) **IDENT-IO- [Cor/pal]** : The feature coronal/palatal of a segment must be preserved in an output.
- (c) **DEP-ɛ**: The output segment ϵ must have input correspondence.

(25) **Prosodic constraints**

- (a) ***I] _σ#**: Avoid the segment [+syll, cor/pal] as an independent syllable at the stem final position.
- (b) **sfx = ɔ̣**: The (past and perfect) suffix is a syllable.
- (c) ***C.V**: Avoid a sequence of a syllabic consonant and a vocalic syllable.
- (d) ***ɔ̣.I.ɔ̣#**: Avoid the segment [+syll, cor/pal] as an independent syllable at the stem medial position.
- (e) **DEP-ɔ̣**: An output syllable must have its input correspondence.

Below, from (26) to (33) are how the different output forms in (21) perform on the constraints from (22) to (25). In (26) are the outputs of interest for this paper; that is, the case of vowel doubling before [jɛ]. In (27) and (28) are two other permissible output forms in Asante Twi. Output forms from (29) to (33) are ungrammatical (i.e. impermissible). In (26b) are the list of constraints that output forms in (26a) respect; these output forms violate constraints in (26c).

(26) Permissible output forms with the endings: ...VVje#

(26a) Outputs	(26b) Constraint non-violation (by output forms in (26a))	(26c) Constraint violation (by output forms in (26a))
(i) sa.a.je (ii) hu.u.je (iii) pa.mɔ.ɔ.je	(i) *CV-[cor/pal] (<i>Forms in 27a violate this constraint</i>) (ii) *I]_σ# (<i>Forms in 27a, 28a, 33a violate this constraint</i>) (iii) *σ.I.σ# (<i>Forms in 29a, 30a, violate this constraint</i>) (iv) IDENT-IO-[cor/pal] (<i>Forms in 31a violate this constraint</i>) (v) sfx = σ (<i>Forms in 32a violate this constraint</i>) (vi) *C.V (<i>The form in 33a violates this constraint</i>)	(i) DEP-σ (ii) DEP-ε

From (27) to (33) below are statements on how other candidate forms perform on constraints from (22) to (25).

(27) Permissible output forms with the endings: ...V.i# ~ ...V.I#

(a) Outputs	(b) Constraint Violation	(c) Constraint non-violation
(i) sa.I (ii) hu.i (iii) pa.mI.I ~ pa.mɔ.I	(i) *CV-[cor/pal] (ii) *I]_σ#	(i) IDENT-IO-[cor/pal] ; (ii) sfx = σ ; (iii) *C.V ; (iv) *σ.I.σ# ; (v) DEP-σ ; (vi) DEP-ε

(28) Permissible output forms with the endings: ...V.V.i# ~ ...V.V.I#

(a) Outputs	(b) Constraint violation	(c) Constraint non-violation
(i) sa.a.I (ii) hu.u.I (iii) pa.mI.I.I ~ pa.mɔ.ɔ.I	*I]_σ#	(i) *CV-[cor/pal] ; (ii) IDENT-IO-[cor/pal] ; (iii) sfx = σ ; (iv) *C.V ; (v) *σ.I.σ# ; (vi) DEP-σ ; (vii) DEP-ε

(29) Impermissible output forms with the endings: ...**V.I.ɛ#** ~ ...**V.i.ɛ#**

(a) Outputs	(b) Constraint violation	(c) Constraint non-violation
(i) sa.I.ɛ (ii) hu.i.ɛ (iii) pa.mɔ.I.ɛ	(i) * σ.I.σ# (ii) DEP-σ (iii) DEP-ɛ	(i) * CV-[cor/pal] ; (ii) IDENT-IO-[cor/pal] ; (iii) * I _{σ#} ; (iv) sfx = σ ; (v) * C.V

(30) Impermissible output forms with the endings: ...**V_{αF}.V_{αF}.I.ɛ#** ~ ...**V_{αF}.V_{αF}.i.ɛ#**

(a) Outputs	(b) Constraint violation	(c) Constraint non-violation
(i) sa.a.I.ɛ (ii) hu.u.i.ɛ (iii) pa.mɔ.ɔ.I.ɛ	(i) * σ.I.σ# (ii) DEP-σ (iii) DEP-ɛ	(i) * CV-[cor/pal] ; (ii) IDENT-IO-[cor/pal] ; (iii) * I _{σ#} ; (iv) sfx = σ ; (v) * C.V

(31) Impermissible output forms with the ending: ...**V.ɛ#**

(a) Outputs	(b) Constraint violation	(c) Constraint non-violation
(i) sa.ɛ (ii) hu.ɛ (iii) pa.mɔ.ɛ	(i) sfx = σ (ii) IDENT-IO-[cor/pal] (iii) DEP-ɛ	(i) * CV-[cor/pal] ; (ii) * I _{σ#} ; (iii) * C.V ; (iv) * σ.I.σ# ; (v) DEP-σ

(32) ...**C_{I_{sfx}}#**

(a) Outputs	(b) Constraint violation	(c) Constraint non-violation
pa.m_{I_{sfx}}	sfx = σ	(i) * CV-[cor/pal] ; (ii) IDENT-IO-[Cor/pal] ; (iii) * I _{σ#} ; (iv) * C.V ; (v) * σ.I.σ# ; (vi) DEP-σ ; (vii) DEP-ɛ

(33) ...**C.I#** outputs

(a) Outputs	(b) Constraint violation	(c) Constraints non-violation
pa.m.I	(i) * I _{σ#} (ii) * C.V	(i) * CV-[cor/pal] ; (ii) IDENT-IO-[Cor/pal] ; (iii) sfx = σ ; (iv) * σ.I.σ# ; (v) DEP-σ ; (vi) DEP-ɛ

The ranking argument that selects output forms in (26a) as optimal over those from (27a) to (33a) is:

(34) *CV-[cor/pal], *I] _o#, *o'.I.o'#, *C.V, IDENT-IO-[cor/pal], sfx = o'
 >> DEP-o', DEP-e

Candidate forms in (26a) do not violate constraints in (26b) and it is for this reason that constraints in (26b) are ranked above those in (26c) in (34). In bracket, against constraints in (26b), is a list of output forms from (27) to (33) which violate which of the high ranking constraints.

The ranking argument in (34) presents verb stems with the endings ...VVjε# as the sole permissible output forms. The strict ranking argument in (34) is not sustainable since forms in (27a) and (28a) are equally grammatical in Asante Twi. My analytical position, therefore, is that some of the constraints outlined in (22) to (25) are ranked freely in the Asante sub-variety of Akan grammar and explains why forms in (27a) and (28a) are also permissible in Asante Twi. The fact that the ranking argument is free for some constraints in Asante Twi accounts for the said alternation in past affirmative and perfect negative verb forms. Below in (35) is the definition of free ranking as represented in Kager (1999):

(35) **Interpretation of free ranking:**

Evaluation of the candidates set is split into ... subhierarchies, each of which selects an optimal output. One subhierarchy has C₁ >> C₂, and the other C₂ >> C₁ [etc.]. (Kager 1999: 406).

The subhierarchies in Asante sub-variety of Akan grammar are more than two for the current data. There are three subhierarchies that have produced the three permissible output forms in the Asante Twi as in (36) below.

(36)

Inputs		Permissible output forms		
		(a)	(b)	(c)
(i)	/sa-I/	sa.I	sa.a.I	sa.a.jε
(ii)	/hu-I/	hu.i	hu.u.i	hu.u.jε
(iii)	/pam-I/	pa.mI.I pa.mU.I	~ pa.mI.I.I ~pa.mU.U.I	pa.mU.U.jε

Following are the free ranking arguments for the three permissible output forms using the permissible output forms of **sa** ‘fetch’ (36-i). Four of the eight constraints that freely rank are: ***CV-[cor/pal]**, ***I_o#**, **DEP-σ** and **DEP-ε**. The list consists of two faithfulness constraints (i.e. **DEP-σ** and **DEP-ε**), and two markedness constraints (i.e. ***CV-[cor/pal]**, ***I_o#**); or two segmental/featural constraints (i.e. ***CV-[cor/pal]** and **DEP-ε**) and two prosodic constraints (i.e. **DEP-σ** and ***I_o#**). From (37) to (39) are the free ranking possibilities or subhierarchies. The free ranking argument in (37) selects output forms in (36a) over those in (36b) and (36c), (38) selects forms in (36b) over those in (36a) and (36c), while (39) selects forms in (36c) over those in (36a) and (36b).

(37) Faithfulness >> Markedness: **DEP-σ, DEP-ε** >> ***CV-[cor/pal], *I_o#**

Input: /sa +- I/	DEP-σ	DEP-ε	*CV- [cor/pal]	*I_o#
☞ (a) sa.I			*	*
(b) sa.a.I	*!			*
(c) sa.a.jɛ	*	*		

(38) Featural/segmental constraints >> Prosodic constraints:

***CV-[cor/pal], DEP-ε** >> **DEP-σ, *I_o#**

Input: /sa +- I/	*CV- [cor/pal]	DEP-ε	DEP-σ	*I_o#
(a) sa.I	*!			*
☞ (b) sa.a.I			*	*
(c) sa.a.jɛ		*!	*	

(39) Markedness >> Faithfulness: ***CV-[cor/pal], *I_o#** >> **DEP-σ, DEP-ε**

Input: /sa +- I/	*CV- [cor/pal]	*I_o#	DEP-σ	DEP-ε
(a) sa.I	*	*		
(b) sa.a.I		*!		
☞ (c) sa.a.jɛ			*	*

In (37) the two Faithfulness constraints (**DEP-σ** and **DEP-ε**) outrank the two markedness constraints (***CV-[cor/pal]**, ***I_o#**). In (38), the two featural/segmental constraints (***CV-[cor/pal]** and **DEP-ε**) outrank the two prosodic constraints (**DEP-σ** and ***I_o#**).

Argument ranking in (39), is the inverse of (37) – the two markedness constraints (***CV-[cor/pal]**, ***I]_σ#**) rather outrank the two faithfulness constraints (**DEP-σ** and **DEP-ε**).

Below are the full ranking arguments that select the different permissible output forms.

(40)

- (a) ***CV-[cor/pal]**, ***I]_σ#**, ***σ.I.σ#**, ***C.V**, **IDENT-IO-[cor/pal]**, **sfx = σ**
 > > **DEP-σ**, **DEP-ε**
- (b) **sa.a.jε** > **sa.I**, **sa.a.I**, ***sa.I.ε**, ***sa.a.I.ε**, ***sa.ε**
- (c) **hu.u.jε** > **hu.i**, **hu.u.i**, ***hu.i.ε**, ***hu.u.i.ε**, ***hu.ε**
- (d) **pa.mσ.σ.jε** > **pa.mσ.I** ~ **pa.mI.I**, **pa.mσ.σ.I**, ***pa.mσ.I.ε**, ***pa.mσ.σ.I.ε**,
***pa.mσ.ε**, ***pa.mI_{sfx}**, ***pa.m.I**

(41)

- (a) ***CV-[cor/pal]**, **DEP-ε**, ***σ.I.σ#**, ***C.V**, **IDENT-IO-[cor/pal]**, **sfx = σ**
 > > **DEP-σ**, ***I]_σ#**
- (b) **sa.a.I** > **sa.I**, **sa.a.jε**, ***sa.I.ε**, ***sa.a.I.ε**, ***sa.ε**
- (c) **hu.u.i** > **hu.u.jε**, **hu.i**, ***hu.i.ε**, ***hu.u.i.ε**, ***hu.ε**
- (d) **pa.mI.I.I** ~ **pa.mσ.σ.I** > **pa.mσ.σ.jε**, **pa.mI.I** ~ **pa.mσ.I**,
***pa.mσ.I.ε**, ***pa.mσ.σ.I.ε**, ***pa.mσ.ε**, ***pa.mI_{sfx}**, ***pa.m.I**

(42)

- (a) **DEP-σ**, **DEP-ε**, ***σ.I.σ#**, ***C.V**, **IDENT-IO-[cor/pal]**, **sfx = σ**
 > > ***CV-[cor/pal]**, ***I]_σ#**
- (b) **sa.I** > **sa.a.jε**, **sa.a.I**, ***sa.I.ε**, ***sa.a.I.ε**, ***sa.ε**
- (c) **hu.i** > **hu.u.jε**, **hu.u.i**, ***hu.i.ε**, ***hu.u.i.ε**, ***hu.ε**
- (d) **pa.mI.I** ~ **pa.mσ.I** > **pa.mσ.σ.jε**, **pa.mσ.σ.I**, ***pa.mσ.I.ε**,
***pa.mσ.σ.I.ε**, ***pa.mσ.ε**, ***pa.mI_{sfx}**, ***pa.m.I**

In (40a) is the ranking argument that selects the verb stem output candidate consisting of **jε** that is preceded by two identical vowels. The ranking argument in (41a) selects permissible verb-stem outputs consisting of the ending **...VVI#**; **I** or **i** is stem final and is preceded by two identical vowels. The ranking argument in (42a) is shared by every dialect of Akan.

5. Conclusion

The Asante subvariety of Akan grammar guards outputs against impermissible distribution and sequencing of prosodic and segmental units. The goal of this paper has been to establish the well-formedness requirements that motivate certain rule applications and ordering (i.e. in rule-based linear and non-linear analysis of the data) or the constraints and constraint argumentations that promote certain output forms over others (i.e. in the optimality theoretic analysis of the data). From the rule-based account of the data, an independent syllabic high is dispreferred at two points, stem-finally and stem-medially. A syllable is augmented to redeem the latter, but ends up creating a dispreferred output which is resolved through vowel doubling. Vowel doubling displaces the independent syllabic **ɪ**. The delinked **ɪ** either reassociates as a nucleus of a succeeding syllable (as **ɪ**), or as an onset of a succeeding syllable (as **j**) after **ɛ** insertion. The Asante variety of Akan grammar imposes strict sequential ordering on the rules: syllable insertion, vowel doubling/lengthening and **ɪ** delinking, **ɛ** insertion and onset formation (i.e. where **ɪ** is realized as **j** in an onset slot). These rules apply conjunctively to derive the unique variety of the past affirmative and the perfect negative verb stem data in Asante. The rule on syllable insertion precedes and feeds the rule that doubles a vowel within the final syllable of the verb root; the rule that inserts the default **ɪ** vowel after a CVC verb-root precedes the rule on vowel doubling. That is, the vowel that undergoes doubling in CVC verb roots is the epenthetic **ɪ**, the default vowel. Vowel doubling delinks the **ɪ** segmental content of the past/perfect syllable, and creates input for either **j** onset formation (after **ɛ** insertion) or **ɪ** reassociation as nucleus (a process that blocks the application of the **ɛ** insertion rule). The delinked **ɪ** of the past/perfect syllable reassociates to a succeeding onset slot to be realized as **j**, but to a succeeding nuclear anchor to remain **ɪ**. The **ɛ** insertion rule feeds the onset formation rule (i.e. the reassociation of **ɪ** as **j**, an onset). There is feeding serialism.

Phonological processes apply to achieve prosodic and phonotactic well-formedness. A single prosodic well-formedness requirement underlies the rule on syllable insertion and vowel lengthening. The dispreference of an independent high vowel syllable is what triggers both syllable insertion (at the stem final position) and vowel doubling (at the stem medial position). The grammar applies different phonological strategies to resolve violations of this single condition at different phonological environments. A violation of this condition is severer at the stem medial position than at the stem final (clause-final) position, and explains the optionality of the syllable insertion rule. Prosodic well-formedness conditions also underlie the rule that inserts **ɪ** after CVC verb roots. The **ɪ** insertion rule applies because C.V is an impermissible syllable sequence in Akan, and the past/perfect suffix must be syllabically independent.

In OT terms, the fact that the rest of the constraints outrank these two faithfulness constraints, **DEP- σ** and **DEP- ϵ** , is what selects verb stems with **j ϵ** preceded by two identical vowels over other output candidates. The other output candidates in the competition (i.e. the non-optimal candidate forms) violate either one or more of these high ranking constraints: ***CV-[cor/pal]**, ***I $_{\sigma}$ #**, *** σ .I. σ #**, ***C.V**, **IDENT-IO-[cor/pal]**, **sfx = σ** . We also identified free ranking as a mechanism in the OT grammar for dealing with alternation in verb stems. In effect, all that Asante dialect of Akan does to select one permissible variant over another is reverse the four constraints, ***CV-[cor/pal]**, ***I $_{\sigma}$ #**, **DEP- σ** and **DEP- ϵ** , along these broad subgroupings of constraints in phonological theory, namely faithfulness, markedness, segmental/featural and prosodic constraints. The two markedness constraints (i.e. ***CV-[cor/pal]**, ***I $_{\sigma}$ #**) outrank the two faithfulness constraints (i.e. **DEP- σ** and **DEP- ϵ**) in the ranking argument that selects verb stems with the **VVj ϵ** ending, as optimal, over equally grammatical output forms. The inverse application of [Markedness >> Faithfulness], which is [Faithfulness >> Markedness], selects a candidate that is widely accepted, or shared, by the different dialects of Akan.

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