

PHONOLOGICAL ADAPTATION OF ENGLISH LOANWORDS IN GONJA

Abstract

This paper presents an Optimality Theoretic (Prince and Smolensky 1993) analysis of the phonological adaptation of English loan words in Gonja, a North Guang language spoken by about 310,000 people who mainly reside in the Savannah Region of Ghana. The paper focuses on two main phonological processes; consonant clusters and illicit coda resolution. The paper finds that Gonja strictly prohibits the occurrence of consonant clusters and only permits codas in cases of CVN, CVI(?), CV(r). Regarding the repair strategies, the paper shows that Gonja uses an epenthetic vowel to break both consonant clusters and illicit codas. Additionally, the paper shows that the insertion of the epenthetic vowel as well as the deletion of the illicit coda feeds another phonological process: re-syllabification. Regarding the OT analysis, the paper posits the interaction of five main constraints, which are ranked as follows: CODA COND,* COMPLEX, EVC >> MAX-IO >> DEP-IO.

Keywords: *Loanwords, Gonja, English, phonological adaptation, optimality theory*

1. Introduction

Borrowing, according to Arlotto (1972), refers to the process through which languages or dialects incorporate linguistic elements from other languages. The tendency for languages to borrow from each other is very well documented (Adomako, 2008; Chang, 2008; Hayes-Harb and Cheng, 2016; Kenstowicz, 2003; Paradis, 1996; Uffmann, 2002, etc.). According to Campbell (2011: 58), the reasons for this tendency vary widely and may include lexical need, prestige, or even derogation. A critical audit of the lexicon of Gonja provides evidence that the language has borrowed extensively from many languages, including Arabic, Hausa, Twi, Safaliba, Vagla and, more importantly for this paper, English. The influence of English on Ghanaian languages, in general, is self-evident. For instance, the development of an English-based pidgin in Ghana ("Ghanaian pidgin") is a clear manifestation of the influence and impact of English on Ghanaian languages. The continued use of English as the official language and the language for formal education in Ghana is perhaps the most telling influence of English on Ghanaian society. Indeed, the predominant use of English in all official functions means that Ghanaians, and for that matter, the Gonja people, come into contact with English daily. It is thus not surprising that many Ghanaian languages have a large number of English loan words. (See Akan, Adomako, 2008; Ewe, Wornyo, 2016, Adjei & Agbozo, 2014, etc.). As rightly noted by Davis (1993:1), loan words sometimes have phonological features that do not conform to the phonotactics of the recipient language. In such cases, the recipient language employs various repair strategies to phonologically adapt (nativise) the loan words to conform to the phonotactics of the recipient language. These repair strategies may vary widely depending on the language and may take the form of segmental features, prosodic patterns, and phonotactic rules. See (Campbell, 1998 and Adomako, 2008). This paper provides an analysis of the phonological adaptation of English loanwords in Gonja, a North Guang language spoken by some 310,000 people mainly in the Savannah Region of Ghana (Lewis, et al., 2016). The paper discusses three repair strategies (Vowel epenthesis (in word-initial, word-

Commented [A1]: How do you break illicit codas? Do you mean to avoid illicit codas?

Commented [A2]: I suppose to mean vowel epenthesis.

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medial and word-final positions), illicit coda resolution and re-syllabification) deployed to phonologically adapt English loanwords to conform with Gonja phonotactics. The paper adopts the Optimality Theory (OT) framework as proposed by Prince and Smolensky (1993) in the analysis of the data. The paper is in six sections. Section one is the introduction. Section two provides a background of the language while section three introduces the theoretical framework. Section four is the data analysis. Section five presents an OT analysis and representation of the data. The final section is the conclusions.

2. Background

2.1 The language

Gonja, known by the natives as Ngbanyito is a Niger-Congo, Atlantic-Congo, Volta-Congo, Kwa, Nyo, Potou-Tano, Tano, Guang, North Guang language, spoken by about 310,000 people who reside mainly in the Savannah Region of Ghana. Gonja has two main dialects (Ngbanyito and Choruba). Gonja is surrounded and influenced by several languages including Safaliba, Vagla, and Dagaare amongst others. The language is used in all domains and is approved for use as a medium of instruction in lower primary. Gonja is a subject of study in some teacher training colleges and at the University of Education, Winneba.

2.2 An overview of Gonja Phonology

This section provides an overview of the phonology of Gonja. The section is largely based on the Nelson et al., (2016) findings on the language. The section provides a brief discussion on the consonant and vowel inventory, harmony, Syllable structure and Tone.

2.2.1 Consonants

According to Nelson et al., (2016), Gonja has twenty-six consonant phonemes that occur across eight places of articulation and seven manners of articulation features. See Table 1 below.

Table 1: Gonja Consonants

	Bilabial	Labiodental	Alveolar	Alveo-palatal	Palatal	Velar	Labial-velar	Glottal
<i>Plosive</i>	p b		t d			k g	kg gb	ʔ
<i>Fricative</i>		f v	s z	ʃ				h
<i>Nasal</i>	m		n		ɲ	ŋ	ŋm	
<i>Affricate</i>				tʃ dʒ				
<i>Approximant</i>					j		w	
<i>Lateral</i>			l					
<i>Trill/Flap</i>			r					

2.2.2 Vowels

The Gonja vowel inventory consists of nine phonetic vowels that are produced over three tongue positions (front, central and back) and four tongue height levels (high, mid-high, mid-low and low). The vowels are also marked for ATR value. See table (2) below for details.

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Commented [A9]: segmental inventory of Gonja.

Commented [A10]: s

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Commented [A12]: you can also provide information about the set of sounds in each cell where one set is voiced while the other is voiceless.

Commented [A13]: you should provide the page from which you adapted this table.

Commented [A14]: Which sound is this? This looks very strange. Perhaps you intended /kp/?

Table 2: vowels of Gonja

	Front +ATR	-ATR	Central +A TR	- A TR	Back +ATR	- ATR
High	i	ɨ			u	ʊ
Mid-high	e				o	
Mid Low		ɛ				ɔ
Low			a			

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Commented [A16]: If these vowels are phonetic, can you discuss which ones are phonemic and the context in which the additional allophonic vowel are derived?

Commented [A17]: Is there any empirical evidence that [e] and [ɛ], for example, contrast in terms of height and not any other property, say ATR? Note that mid-high and mid-low contrast in terms of height and not tongue root position.

2.2.3 Harmony

According to Nelson et al. (2016), Gonja has an ATR-based vowel harmony system. Consequently, the nine (9) phonetic vowels of the language are classified as either [+ATR] vowels /i, e, o, u/ or [-ATR]: /ɛ, ʊ, ɨ, ɔ/. There is also one (1) neutral vowel /a/ which can occur with either set of vowels. According to Nelson et al. (2016), non-low vowels within the same root morpheme will generally agree in their [ATR] value. That is, in a morpheme with more than one vowel, the vowels will either be all [+ATR], or all [-ATR]. Consider the following words.

Commented [A18]: a

- | | | | |
|-----|------------------|-----|-----------------------|
| 1. | [+ATR] | | [-ATR] |
| (a) | [étùtò] ‘father’ | (d) | [fɛ̀ɛ̀tí] ‘monkey’ |
| (b) | [tèkú] ‘ocean’ | (e) | [lòŋé] ‘hare’ |
| (c) | [ɲífú] ‘flour’ | (f) | [kòlí] ‘to plead/beg’ |

Adopted from Nelson et al., (2016:26)

As noted in the examples above, all the words in examples (1a) - (1c) have only +ATR vowels while the words in (1d) - (1f) have only -ATR vowels occurring in them. Additionally, noun suffixes will usually harmonize with the bases they are attached to. Consider examples (2) and (3) below. In example (2), we find a case where the same noun suffixes /e/ and which is +ATR (in example (2a) harmonizes to become /ɛ/, -ATR in example (2b). Similarly, the noun suffix [kí] which has a +ATR vowel in (3a) harmonizes to become [kí-], -ATR in (3b).

Commented [A19]: [+ATR]

Commented [A20]: [-ATR]. Put the feature in bracket throughout.

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- | | | | |
|-----|--------------------|-----|-------------------|
| 2. | [+ATR] | | [-ATR] |
| (a) | [é-pún?] ‘abdomen’ | (b) | [é-fótí] ‘breath’ |
-
- | | | | | |
|---|-----|-----------------|-----|------------------|
| 3 | (a) | [kí-ɲí] ‘tooth’ | (b) | [kí-bé] ‘market’ |
|---|-----|-----------------|-----|------------------|

Commented [A24]: Is there evidence for the realization of the glottal stop after the alveolar nasal sound?

Adopted from Nelson et al., (2016:27)

2.2.4 Syllable structure

As rightly noted by Nelson et al. (2016:39) the syllable structure of Gonja is “predominantly CV, V, CVN and CVV(?) (where [ʔ] shows up only before pause)” They also note the occurrence of the syllable structure CVl and CVr. Consider the following examples.

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4. (a) CV → [nú] 'hear' (d) V → [é.bɔ] 'necks'
 (b) CVN → [dúŋ] 'bite' (e) CVV(?) → [fàà.ràà?] 'begin'
 (c) CVI(?) → [bí] 'be old' (f) CV(r) → [bír?] 'bathe'

Adopted from Nelson et al., (2016:39)

It is important to add that although Gonja accepts the V syllable structure, the V syllable cannot occur in word-medial position. The potential occurrence of the V syllable in word medial position triggers the deletion of the syllable. Consider the case of the compound below.

5. [kébíâ] + [bí] → [kébíɔbí] → [kébíbí]
 child small baby

In this example, the combination of [kébíâ] 'child' and [bí] 'small' results in the unlicensed structure [ké. bí.â.bí] (* CV-CV-V-CV). This is however resolved by the deletion of the /a/ thus causing the syllable structure to change from * CV-CV-V-CV to CV-CV-CV.

2.2.5 Tone

Like most Ghanaian languages, Gonja is a tone language with two main contrasting tones; High (H) and (L) (Painter 1970; Nelson et al., 2016). The language also has two other contour tones. These contour tones, however, do not contrast meaning. The contour tone can be found mostly in word-final V syllables. See the examples below:

- | 6. | Tone | Transcription | Example |
|-----|---------|---------------|-----------------|
| (a) | High | ['] | wù 'see' L |
| (b) | Low | [`] | wú 'die' H |
| (c) | Contour | [^] | ké-bí-â 'child' |

3. Optimality Theory

According to Prince and Smolensky (1993), the Optimality Theory (OT) is a constraint-based generative grammar theory. "At the heart of OT is the idea of universal constraints, which are nevertheless violable" (Archangeli 1999). The theory seeks to address a few connected issues that have plagued generative phonological theory. For instance, OT addresses what Gouskova and Hall (2009) refers to as "soft universals"; which refers to the tendency of "unrelated languages show evidence of the same or similar constraints, but the constraints do not seem to hold in all languages" (Gouskova and Hall, 2009:531) by assuming that constraints although universal are rankable and violable. By this approach Prince and Smolensky (1993), proposed a move away from the standard generative phonology approaches that were rule-based to a more adaptable constant-based approach that attempts to account for grammar through the interaction of a hieratically organized system of constraints. By way of architecture, Prince and Smolensky (1993) proposed a system that involves three main components:

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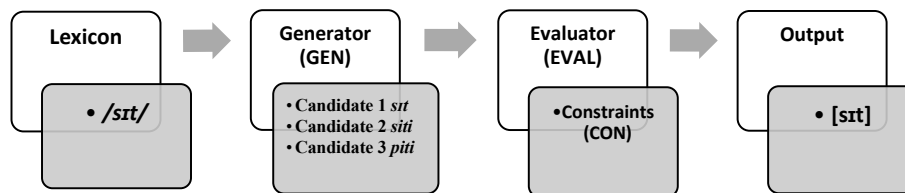
Commented [A28]: It the contour tone realized on a single syllable? is it derived within a context? If a syllable bears a contour tone, then it is likely to be tonemic except the context of its derivation can be provided and explained.

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Commented [A30]: What does this mean?

- A. Constraints (CON): By this, Prince and Smolensky (1993) refer to the component that defines the set of universal violable constraints.
- B. Generator (GEN): This according to Prince and Smolensky (1993) is the component that provides all the possible "output" forms based on the "input"
- C. Evaluator (EVAL): This is the component that selects an optimal output from the set of alternative candidates, given a language-specific hierarchical ordering of constraints. See Figure 1 for a model of optimality theory grammar.

Figure 1: Model of optimality theory grammar



In terms of its operation, Prince and Smolensky (1993) posit a system where the (Lexicon, Generator (GEN), & Evaluator (EVAL)) work together to generate grammatical linguistic forms. As shown in Figure 1 above, the lexicon which includes all the inputs of a language provides the "input" to the GEN. The GEN then provides all the possible "output" forms for the "input" provided by the lexicon. The EVAL based on the hierarchical ranking of the constraints evaluates the candidates produced by GEN to determine the "optimal output". The fundamental distinction between this constraint-based theory and rule-based phonology is the fact that while violation of rules is fatal, violation of constraints is not necessarily fatal. Thus, the optimal candidate is not necessarily the candidate that does not violate rules but the one that adheres to the highly ranked constraints.

The use of the term constraints here refers to universal principles in language that determine the nature of language. The main distinction between constraints and rules is that while rules are "sacrosanct" and thus cannot be violated, constraints can be violated depending on their place in a hierarchy. See (McCarthy & Prince 1993, Prince & Smolensky 1993, McCarthy & Prince 1995). These constraints are categorized into two main types of constraints: markedness constraints and faithfulness constraints. By markedness constraints, Prince and Smolensky (1993) refer to those principles that prohibit "elements that are structurally complex or in some sense difficult or disfavored" (Gouskova, 2009:539). In Linguistics, unmarked structures in a language are those that are relatively simpler and are acquired earlier by children. They also usually occur more frequently in the language. Consequently, markedness constraints refer to those constraints that require the output to be unmarked in structure. A classic example of the **markedness** constraint is the NOCODA constraint. This constraint for instance forbids syllables in a language from having codas. Thus suggesting the preference for open syllables. In contrast, **faithfulness constraints** require outputs (surface representation) to be faithful to the input (underlying representation). This faithfulness constraint disfavors changes to the input. For example, candidates that undergo

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Commented [A32]: The point is not factual. There are rules which violation are not fatal, on the other hand, violations of constraints can be fatal depending on how those constraints are ranked in relation to others. If violation of constraints is 'not necessarily fatal', then on what basis does the optimal candidate out of many possibilities emerge?

Commented [A33]: What does this mean? The adherence? Do you equate it to avoidance?

Commented [A34]: Such generic statements are not helpful. Refer to Chomsky's Principles and Parametres to expatiate this.

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segment deletion or insertion are said to have violated the faithfulness constraint MAX-IO. Thus the more identical the candidate is with the input the better the candidate. In OT framework the process of grammar generation is schematically presented in a “tableau”. The tableau shows the input, candidate output, constraint ranking and violation as well as the optimal output. A sample tableau is presented in Figure 2 below.

Figure 2: Sample Tableau

Input	Constraint 1	Constraint 2	Constraint 3	Constraint 4
Candidate 1		*!		
Candidate 2			*!	
Candidate 3				
☞ Candidate 4				*!

According to the logic of OT, every input has an unlimited number of possible outputs (listed in the input column). These candidates are evaluated based on the set of hierarchically ranked constraints (the top-ranked constraints appearing before the lower-ranked constraints). As shown in figure 2, the optimal candidate is marked by the sign “☞” while violations are marked by the sign “*”. Fatal violations are however marked with the exclamation mark “!”.

The current paper will apply this theoretical framework in the analysis of the phonological processes that English loanwords undergo before they are integrated into the lexicon of Gonja. Consequently, the results will be presented in tableaux.

4. Phonological adaptation of English loanwords in Gonja

As noted in the introduction, Gonja has borrowed extensively from many languages including English. The data from Gonja on English loanwords suggest that adopted words usually undergo some nativization before they are incorporated into the Gonja lexicon. It is also important to note that the level of nativization may vary depending on the level of exposure of the speaker to English. In this regard, two general groups are identified: Monolinguals (*made up of people with very little or no formal education*) and Bilinguals (*made up of people with substantial formal education*). The data suggest that while monolinguals tend to strictly subject the loanwords to Gonja well-formedness criteria, bilinguals do not. For instance, while monolinguals tend to strictly avoid consonant clusters, bilinguals do not. Consider the examples in (7) below.

7.	Word	Phonetic	Monolinguals	Bilinguals
a)	school	/sku:l/	[su.ku:]	[sku:]
b)	blade	/bleɪd/	[bɪ.le.dɪ]	[ble.di]
c)	slit	/slɪt/	[sɪ.lɪ.tɪ]	[slɪ.tɪ]

In examples (7a) - (7c), it is shown that monolinguals break the word-initial consonant clusters in the forms /sku:l/, /bleɪd/ and /slɪt/ by inserting an epenthetic vowel to get [su.ku:], [bɪ.le.dɪ] and [sɪ.lɪ.tɪ] (no clusters). Unlike monolinguals, bilinguals allow the word-initial consonant clusters as shown in the output forms [sku:], [ble.di] and [slɪ.tɪ]. The tendency suggests that while bilinguals are relatively more faithful to the source language, monolinguals are faithful to the native grammar. The current paper will limit its scope to the adaptation strategies monolingual use in adapting English loanwords. The analysis of the data point to an interplay of three main repair strategies

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Commented [A39]: output candidates

Commented [A40]: what level of education do you classify as ‘substantial’?

Commented [A41]: how do you measure the so-called faithfulness? I rather see that they are closer to the source words.

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including vowel epenthesis (*in word-initial, word-medial and word-final positions*), illicit coda resolution and re-syllabification. As will be shown in the ensuing discussion, the application of the vowel epenthesis and illicit coda resolution feeds¹ the re-syllabification of the output forms. Consequently, the discussion will incorporate the re-syllabification into the discussion of the two main repair strategies. In the sections that follow, I discuss each of the above stated repair strategies in detail.

4.1. Consonant cluster resolution and re-syllabification

Consonant clusters, which refer to the co-occurrence of two or more consonant, is a very common feature of English. These consonant clusters occur in words such as School, [sku:l] black etc. However, as shown in section 2.2.4, these structures are strictly prohibited in Gonja. Consequently, borrowed words that have these clusters be it at word initial, medial or final require some phonological adaptation. The data on Gonja shows that Gonja employs vowel epenthesis to break the clusters. Vowel epenthesis according to Urua (2007) refers to the insertion of a vowel in a word. It usually involves the separation of successive sound segments by introducing an intervening vowel segment. Vowel epenthesis in loan words breaks up a sequence of sounds that are undesirable in the phonotactics of a language. For instance, in Arabic, the epenthetic vowel is used to break up illicit CC coda clusters. Similar to the case of Arabic, Gonja grammar deploys the vowel epenthesis to break up illicit CC codas (Alqahtani 2018). The data shows that this adaptation can occur in three positions in the word: word-initial, word-medial and word-final position. The data on Gonja loanwords show that monolinguals prohibit any form of consonant clusters. As shown in examples (8) through (10), the grammar remedies the violation by introducing an epenthetic vowel to break the clusters. First, consider examples in (8).

8.	Word initial consonant clusters		
	Word	Phonetic	Monolinguals
a)	slit	/slit/	[sɪ.lɪ.tɪ]
b)	school	/sku:l/	[su.ku:]
c)	blade	/bleid/	[bi.le.di]

In the examples in (8), it is observed that the loanwords all have onset clusters but in the nativised form, a vowel is inserted between the first two consonants to break up the onset cluster. The insertion of the epenthetic vowel results in a feeding relationship by setting the conditions precedent for the application of another phonological process: re-syllabification. For instance, the insertion of the epenthetic vowel in the form 'slit' /slit/ in (8a) to get [sɪ.lɪ.tɪ] results in a change in the syllable structure of the output. Thus changing it from CCVC to a CV.CV.CV. It is important to note here that the consonant cluster has been re-syllabified into two single consonant onsets. Figure 2 below provides a detailed account of the re-syllabification process.

Commented [A43]: do you mean Alqahtani has studied Gonja epenthesis?

Commented [A44]: Break up

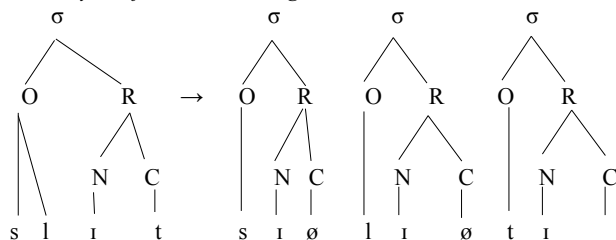
Commented [A45]: Can you explain why these vowels have been used as epenthetic vowels? What informed their selection and not any other vowels?

Commented [A46]: Source words

Commented [A47]: What does this mean?

¹ According to Kiparsky (1968, 1971), where Rule A creates potential inputs to rule B and rule B applies, we say A feeds B. this relationship can also be described by requiring A to precede B.

Figure 2: Re-syllabification involving word initial consonant clusters; /slɪt/ → [slɪ.lɪt]

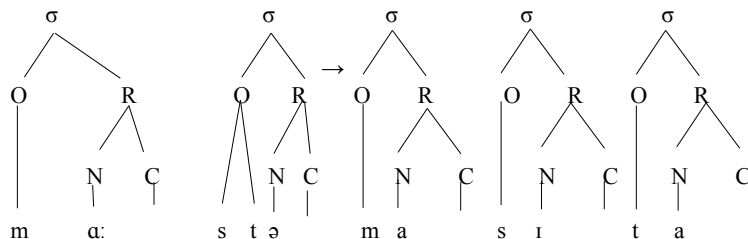


Next, consider examples in (9) where the consonant clusters are in word medial positions. Like the word-initial consonant clusters, the consonant clusters are broken up by inserting an epenthetic vowel. Consider for instance the form /ma:stə/ → /ma.sɪ.ta/. Here, the CV. CCV changes to CV. CV. CV. As with the case of Figure 2 above, the insertion of the epenthetic vowel automatically results in the re-syllabification of the output form. See Figure 3 below for an account of the re-syllabification process involving word medial consonant clusters.

9. **Word medial consonant clusters**

	Word	Phonetic	Monolinguals
a)	inspector	/ɪnˈspektə/	[ɪn.sɪ.pɛ.kɪ.ta]
b)	complete	kəmˈpli:t/	[kəmpɪli:ti]
c)	master	/mɑ:stə/	[mɑ:sɪtə]

Figure 3: Re-syllabification involving word medial consonant clusters; /ma:stə/ → [ma.sɪ.ta]



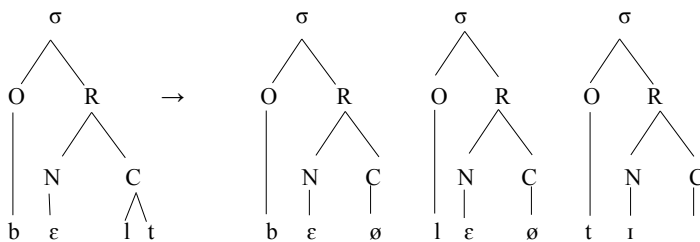
The final set of examples under the discussion on Consonant cluster resolution and re-syllabification show instances of word-final cluster resolution. The resolution of the word-final consonant clusters is no different from the resolution of the word-initial and word-medial, consonant clusters. Here too an epenthetic vowel is used to break the consonant cluster. Consider data in (10) below.

10. Word final consonant clusters

	Word	Phonetic	Monolinguals
a)	belt	/bɛlt/	[bɛ.lɛ.tɪ]
b)	(ice) chest	/tʃɛst/	[tʃɛsɪtɪ]
c)	(ice) chest	/tʃɛst/	/tʃɛst/

As with the word initial and word medial, consonant clusters, the insertion of the epenthetic vowel automatically triggers the re-syllabification of the output. As shown in Figure 4 involving the nativization of 'belt': /bɛlt/ → [bɛ.lɛ.tɪ], the CV.CC is re-syllabified to get the output syllable structure CV.CV.CV.

Figure 4: Re-syllabification involving word final consonant clusters; /bɛlt/ → [bɛ.lɛ.tɪ]



From the above discussion, it can be concluded that monolinguals do not permit any form of consonant clusters. It is also evident that the application of vowel epenthesis as a repair strategy triggers the application of another phonological process: re-syllabification. The discussion so far has accounted for the resolution of consonant clusters in the adaptation of loan words in Gonja. In the next section, I discuss the resolution of illicit codas.

4.2. Illicit coda and re-syllabification

Illicit coda refers to cases where a consonant that is prohibited from occurring in a coda position occurs at the coda position. As shown in section 2.2.4., Gonja allows the occurrence of a coda for only CVN, CVI(?) or CV(r) context. Consequently, where a borrowed word does not conform to this, the language repairs it through vowel insertion. For instance, the loan word 'book' /bʊk/ as shown in data set (11), has an illicit coda because the grammar of Gonja prohibits the occurrence of /k/ as a coda. This occurrence of the illicit coda /k/ is rectified by inserting a vowel /u/ at the word-final position. Similar to the cases involving consonant clusters, the resolution of the illicit coda also triggers the application of the re-syllabification process. For instance, in the case of /bʊk/ → [buku], the syllable structure changes from CVC to CV.CV. Note that the coda of the input form, which is a loanword, becomes the onset of the output. See data set (11) for examples of illicit coda resolution and Figure 5 for an illustration of the re-syllabification process.

Commented [A48]: But did you provided data to show that bilinguals do permit clusters?

Commented [A49]: Does Gonja actually have coda? Note that word-final consonants are not the same coda. Many languages allow certain group of consonants to occur at the final position of words that not necessarily make those consonants codas. Judging from the sonority of the supposed 'codas' in Gonja, I suppose they are rather word-final consonants than codas. Don't forget the glottal is realized only at the surface level. This needs further explanations.

Commented [A50]: What actually informs the selection of [u] and not any other vowels for the repair? This needs to be explained. In the previous data, high front vowels, mid vowels were selected. What account for the various in the quality of the epenthetic vowels?

Commented [A51]: What accounts for the change in the ATR value of the source [-ATR] to [+ATR] in Gonja? From the vowel chart, Gonja has the source vowel.

Commented [A52]: English

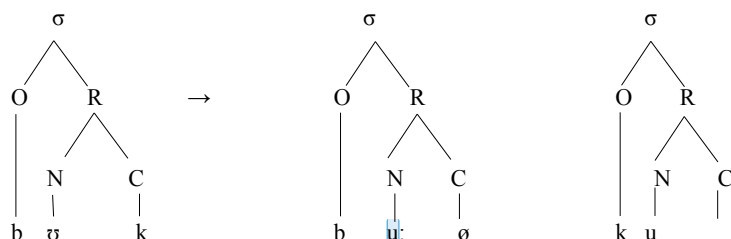
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11. **Examples of illicit coda resolution**

	Word	Phonetic	Monolinguals
a)	book	/bʊk/	[buku]
b)	watch	/wɒtʃ/	[wɒ.tʃi]
c)	bag	/bæg/	[bagi]
d)	report	/rɪ'pɔ:t/	[rɪ'pɔ:ɾi]

Commented [A54]: another question is, who do the supposed monolingual adapt the source words from? Native English speakers or educated Gonja speakers? If the response is the latter, then the input segment might not be the same as the transcribed ones according to Huber (2013) on Ghanaian English. Per Huber findings, it is expected that [buk] should be what the pronunciation will be.

Figure 5: Re-syllabification involving illicit coda; /bʊk/ → [buku]



The discussion in section 4 above has provided a descriptive account of the three main repair strategies including vowel epenthesis, illicit coda resolution and re-syllabification. In the next section, I present an OT account of these repair strategies.

5. OT analysis and Representation

This section presents an OT analysis of the discussion thus far. As noted above OT assumes that the grammar repairs the undesirable structures by applying a set of hierarchically ordered constraints. This section attempts to introduce and justify the constraints at play as well as the ranking of these constraints.

5.1. Constraints

This section introduces the constraints that come to play in the adaptation of English loanwords into Gonja. These constraints are derived from the description of the data presented in (7) through (11). The examples in data sets (7) through (11) show that although the grammar of Gonja allows for the deletion of input segments in the output, the deletion is minimal. This thus suggests the application of the faithfulness constraints MAX-IO; which prohibits deleting. In addition, monolinguals tend not to tolerate any form of complex structure, thus indicating the application of a constraint against complex structures; *COMPLEX. Regarding the issue of coda, the forgoing discussion suggests that although coda is acceptable in Gonja, only specific types of coda are permitted in Gonja. The permission of only specific types of codas indicates the constraint coda condition; CODA COND is at play. To remedy cases of clusters and illicit coda, Gonja tends to insert an epenthetic vowel. This insertion of epenthetic vowels indicates that inserting is not necessarily fatal and that the markedness constraint against inserting; (DEP-IO) is not highly regarded.

Commented [A55]: You have not accounted for how [ɾ] changed to [u]. And again, how a short vowel was lengthened. In 11, we have [buku], but in fig. 5 we see [bu:ku]. There seems to be lack of agreement here.

Commented [A56]: How does illicit coda resolution stand out as an independent strategy since such codas can be resolved by vowel epenthesis?

Commented [A57]: Even before the formalization, there have been questions about the pattern of the adaptation yet to be answered. What are the contexts of the phonological adaptations? What are the epenthetic vowels? Why are they chosen as epenthetic vowels? In what contexts are they chosen? Do neighbouring segments have any role to play in their selection? Does Gonja have default epenthetic vowel/s? In answering these questions the author/s will contribute to the ongoing debate about the mode of adaptation across languages.

Commented [A58]: of what?

Commented [A59]: delete

Commented [A60]: the question again is, are the supposed coda in Gonja tone-bearing? Aren't they word-final consonants instead? Is CVN a basic syllable structure of Gonja? This needs to be clarified.

Commented [A61]: insertion

Regarding the quality of the epenthetic vowel, the data suggest that only specific vowels can occur as the epenthetic vowel. This is despite the fact that cases like school' /sku:l/ → [su.ku:] give the impression that the epenthetic vowel is a duplicate of the vowel in the input. This assumption wrongly predicts for instance that 'belt' /belt/ will be adapted to [bɛ.lɛ.tɛ]. This thus predicts the existence of an epenthetic vowel condition (EVC). An analysis of the data suggests that only [u, ʊ, i and ɪ] can serve as epenthetic vowels and the choice depends on the;

- I. The place features of the already existing vowel sound
- II. The ATR value of the sound already existing sound

More specifically the EVC in Gonja dictates that speakers use [u] when it is a labial and is [+ATR] and when it is labial [-ATR] use [ʊ]. Elsewhere use [i] for [+ATR] and [ɪ] for [-ATR]. The discussion thus far has established the interplay of the under-listed constraints.

- a. MAX-IO: All input segments must have output correspondents
- b. *COMPLEX: A syllable must not have a complex segment. Thus, a syllable must be V, CV or VC.
- c. CODA COND: Coda is permissible only in cases of CVN, CVI and CVr
- d. DEP-IO: Output segments have input correspondents (i.e. no epenthesis).
- e. EVC: Only [u], [ʊ], [i] and [ɪ] can occur as epenthetic vowels.

Having established the existence of the above constraints in the process of loanword adaptation in Gonja, I proceed to rank the constraints in the next section.

5.2. Ranking of constraints

Regarding the ranking of the constraints, the data show that the grammar of Gonja prohibits clusters. This thus means that *COMPLEX is highly ranked. Additionally, the strict adherence to CODA COND and EVC suggests that both constraints are ranked high. On the other hand, the use of epenthesis as a repair mechanism to ensure the fulfilment of *COMPLEX suggests that DEP-IO is low-ranked in Gonja. Also, the existence of segment deletion as a repair strategy means that MAX-IO is not very highly ranked.

In terms of the internal ranking of the high-ranked constraints, the data gathered so far suggest that the CODA COND, *COMPLEX, and EVC are equally ranked as a single violation of any of them is fatal.

Regarding the ranking between MAX-IO and DEP-IO, the data suggest that MAX-IO is ranked higher than DEP-IO because violations of DEP-IO are more tolerable than the violation of MAX-IO. For instance, as shown in Tableau 2, [sɪ.lɪ.tɪ] is preferred to [sɪlɪ] despite the former violating DEP-IO twice. On the other hand, a single violation of MAX-IO by [sɪlɪ] is fatal. The result of the above is the following ranking:

CODA COND, *COMPLEX, EVC >> MAX-IO >> DEP-IO

Commented [A62]: These information are needed at the discussion of the data and not at the formalization level. They sound new to the reader because none these were mentioned there.

Commented [A63]: You are providing this information for the first time. We need it at the data presentation and discussion section.

Commented [A64]: Whose definitions of constraints are you using?

Commented [A65]: Having

Commented [A66]: You are not to 'establish the existence of constraints', they are already in the minds on the speakers. You are only using them for your analysis.

5.3. Tableau representations

With the constraints ranked, as shown above, this section uses tableaux to show how the constraints interact to produce the optimal outputs. In this section, I present 5 tableaux to exemplify the various scenarios in the data. In this regard, I will present a tableau showing how the grammar handles instances of epenthesis in the word-initial position, epenthesis in the word-medial position and epenthesis in the word-final position. The tableaux also show how the grammar of Gonja resolves cases of illicit codas.

5.2.1 Tableau representations for vowel epenthesis

As noted earlier, the language uses the epenthetic vowel break consonant clusters. Tableau 1 to Tableau 4 show how the grammar uses epenthetic vowels to break consonant clusters. First, consider Tableau 1 where the grammar resolves a case of a consonant cluster in the word-initial position.

Tableau 1: Epenthesis in onset position with a wrong winner

School /sku:l/	CODA COND	*COMPLEX	EVC	MAX-IO	DEP-IO
[sku:]		*!			
saku:l			*!		
su.ku.lu					***!
☛ su.kul					*
☞ suku:				*!	*

It is important to note that Tableau 1 above predicts a wrong winner. This prediction of a wrong outcome could be an indication that the word may not have been borrowed directly from English but perhaps from other Ghanaian languages where some form of adaptation had already taken place. Next, consider Tableau 2 where the ranking predicts a correct outcome.

Tableau 2: Epenthesis in onset position with a correct winner

slit /slɪt/	CODA COND	*COMPLEX	EVC	MAX-IO	DEP-IO
sli		*!		*	
salit		*!	*!		**
[sɪlɪt]	*!				
sɪlɪ				*!	*
☞ sɪ.lɪ.tɪ					**

As illustrated in Tableau 2, the preferred candidate is [sɪ.lɪ.tɪ] because although it violates the low-ranked constraint DEP-IO, it does not violate the high-ranked constraints CODA COND, *COMPLEX, EVC and MAX-IO. Next, consider Tableau 3 where a case of word medial consonant cluster is broken via the use of an epenthetic vowel.

Tableau 3: Epenthesis in word medial position

Master /'mɑ:stə/	CODA COND	*COMPLEX	EVC	MAX-IO	DEP-IO
mɑ.sa.ta			*!		
mɑs.tə	*!				
mɑ.stə		*!			

Commented [A67]: tableaux

Commented [A68]: tableaux

Commented [A69]: to repair

Commented [A70]: break up or resolve

Commented [A71]: the practice is that you don't begin your analysis with the complex and unresolved issues. You rather push it to the end of the analysis.

Commented [A72]: why is sku: not violating this MAX-IO constraint? How do you account for the seeming vowel lengthening? Supposing another possibility which is [suku] is introduced, what will prevent it from being optimal? Also, as a practice, always have the same inputs as the first possibility or candidate and show how the ranking will disprefer them as the optimal candidates.

Commented [A73]: Per your ranking, silit looks worse than even salit, sli and sili. In reality this should not be the case. I suppose it should be better than salit.

ma.tə				*!	
☞ ma.si.ta					*

Similar to the case in Tableau 2 above, the preferred candidate in Tableau 3 is predicted because it only violates the low-ranked constraint DEP-IO. It however does not violate the high-ranked constraints CODA COND, *COMPLEX, EVC and MAX-IO. The final tableau on the use of the epenthetic vowels to remedy consonant clusters is presented in Tableau 4 below. Here an epenthetic vowel is used to break a consonant cluster at the word-final position.

Tableau 4: Epenthesis in word-final position

Belt /bɛlt/	CODA COND	*COMPLEX	EVC	MAX-IO	DEP-IO
bɛlt	*!				
bɛ.lɛ.tɛ			*!		**
blɛt	*!	*		*	*
bɛ.lɛ				*!	*
☞ bɛ.lɛ.tɪ					**

As with the cases in Tableau 2 and Tableau 3, the preferred candidate in Tableau 4 is preferred because also does not violate the higher ranked CODA COND, *COMPLEX, EVC and MAX-IO. The examples above are cases where Tableaus are used to show how the grammar of the language phonologically adapts English loan words that have consonant clusters in word-initial position, word medial and word-final positions. Note that the order of the constraints does not change. Instead, the same constraint order is used to resolve all three scenarios. Thus giving credence to the constraint selection and ranking. In the next section, I show how the same constraint selection and ranking are used to resolve cases of illicit coda in the phonological adaptation of English loan words into Gonja.

5.2.2. Tableau depicting illicit coda

This final tableau presents a sample analysis of a case of an English word with an illicit coda being phonologically adapted into Gonja. As with all the Tableaus so far, the analysis in Tableau 5 shows that the candidate that violates the higher ranked CODA COND, *COMPLEX, EVC and MAX-IO cannot emerge as the preferred candidate. Instead, the winning candidate violates only the low-ranked DEP-IO.

Tableau 5: Illicit coda

Book / bʊk/	CODA COND	*COMPLEX	EVC	MAX-IO	DEP-IO
buk	*!				
bu.				*!	**
bu.ka			*!		*
☞ bu.ku					*

Commented [A74]: Why shouldn't this candidate violate EVC when it epenthesizes a non-high vowel? Also, you will need another constraint to ensure segments in the output are faithfully represented in the input; an IDENT constraint. How do you distinguish between epenthesis for cluster repairs and epenthesis for coda repairs? Positionally they are not the same.

Commented [A75]: There should be comma here.

Commented [A76]: How different is this section from previous ones? We have already seen repair of coda. You have not accounted for deletion yet.

6. Conclusion

The paper has discussed the phonological adaptation of English loanwords in Gonja with a focus on monolinguals. The paper found that while monolinguals tend to strictly subject the loanwords to Gonja well-formedness criteria, bilinguals do not. The analysis of the data points mainly to the interplay of two main repair strategies: vowel epenthesis and illicit coda resolution. The paper shows that the application of these two repair strategies creates the conditions precedent for the application of re-syllabification. Thus, the repair strategies of the use of vowel epenthesis and illicit coda resolution feed the re-syllabification. In terms of constraint selection and ranking, the paper proposes the involvement of five constraints: CODA COND,* COMPLEX, EVC, MAX-IO and DEP-IO. The paper further proposes that the constraints are ranked as follows CODA COND,* COMPLEX, EVC >> MAX-IO >> DEP-IO.

Commented [A77]: If the illicit coda is resolved through epenthesis, as you have shown, then you are talking about the same epenthesis.

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