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Vowel Epenthesis in Arabic Loanwords in Hausa

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Abstract

Vowel epenthesis is discussed in this paper as a phonological process utilized to avoid codas in Arabic loanwords in Hausa language in light of Optimality Theory (OT), as an analytical framework, even though this language permits codas in heavy syllables of the form CVC (Caron, 2011). This process results in having disyllabic, trisyllabic, or qadri-syllabic words (words with four syllables) depending on the forms of Arabic loanwords as well as mono-syllabic words with final bi-consonant clusters. This study primarily relies on extant literature including theses, books, and articles. Furthermore, the authors' intuition is crucially deemed the judge on the facts of the data. This paper concludes that codas in Arabic loanwords in Hausa motivate vowel epenthesis either once or twice, depending on the forms of words; i.e. disyllabic or monosyllabic. Also, the number of vowel insertion depends on the number of consonants in the coda position, i.e. /CVCC/→ vowel epenthesis→ [CVC.C$\underline{\text{V}}$] or [CV.C$\underline{\text{V}}$.C$\underline{\text{V}}$].

Keywords: Arabic loanwords in Hausa, Hausa language, vowel epenthesis, Optimality Theory (OT)

1. Introduction

Vowel epenthesis is considered to be a phonological process used in the adaptation of loanwords in languages (Cain 1986; Park 1987; Alkinlabi 1993; Mwihaki 2001; Uffmann 2002, 2005; Kenstowicz 2007; Adomako 2008; Repetti 2012). Languages with restrictions on syllable structure permit vowel epenthesis in order to satisfy these restrictions when dealing with borrowing words from other languages (Uffmann, 2006). Consider the following examples (epenthetic vowels are in bold typeface):

(1) Vowel epenthesis in loanwords:

Yoruba	k**í**láàs**i**	‘class’	(Alkinlabi, 1993)
Kikuyu	ng**i**rath**i**	‘glass’	(Mwihaki, 2001)
Japanese	s**u**toraik**u**	‘strike’	(Park,1987)
Samoan	s**i**kaut**i**	‘scout’	(Cain, 1986)
Fijian	s**i**piinij**i**	‘spinach’	(Kenstowicz, 2007)
Akan	s**u**tɔp**u**	‘stop’	(Admako, 2008)
Shona	g**i**.ri:n**i**	‘green’	(Uffmann,2002)

Epenthetic vowels in English loanwords in (1) are motivated by complex onsets as well as codas, starting from Yorupa and ending up with Shona. In other words, epenthetic vowels occur in two positions in English loanwords with initial consonant clusters and codas in order to conform to the restrictions on native syllable structure in languages including Yoruba, Kikuyu, Japanese, Samoan, Fijian, Akan, and Shona.

This paper aims to shed light on codas in Arabic loanwords in Hausa language, as one of African languages. These word are borrowed from Classical Arabic (Yalwa 1992). The five sources where Hausa borrowed Arabic words from are Islam and Trade, Literature and Grammar, Islamic School System, Administration, Law, Politics, and Modering Writing (Yalwa 1992). The reason for seeking for codas in particular is because Classic Arabic does not permit initial consonant clusters, while it can tolerate final bi-consonant clusters as well as single codas (Watson 2011). Therefore, the maximum syllable structure in Classic Arabic is of the canonical shape CVCC (Watson 2011). To achieve this aim, there are two questions should be addressed; what are the restrictions on syllable structure in Hausa? How codas in Arabic loanwords are treated in Hausa?

In the next sections, we will view some previous studies done on the adaptation of loanwords using vowel epenthesis, as a main repair strategy. The following section is possessed by some background knowledge about the phonology in Hausa. This paper ends up with the analysis of Arabic loanword adaptation in Husa using OT, as a framework, plus conclusion, as a final section, where findings are shown.

2. Literature Review

There are many studies conducted on loanwords adaptations in languages by using the strategy of vowel epenthesis. Broselow (1984, 1992) analyzes the adaptation of English loanwords in Egyptian Arabic. According to her, some initial bi-consonantal clusters in English loanwords in Egyptian Arabic motivate internal epenthesis, whereas other types of initial bi-consonantal clusters motivate prosthesis (initial epenthesis). She notes that initial obstruent+ sonorant clusters motivate internal epenthesis, whereas voiceless obstruents + stop (ST) clusters trigger prosthesis.[1] Consider the following examples below:

(2) Egyptian Arabic (Broselow 1984, 1992)

a) /skaɪ/ ‘sky’ → [ʔiskii]
b) /stʌdi/ ‘study’→ [ʔistadi].
c) /plæstik/ ‘plastic’ → [bilastik][2]
d) /trænsleɪt/ ‘translate’ → [tiransilet]
e) /slaɪd/ ‘slide’→ [silaid]
f) /sprɪŋ/ ‘spring’→ [ʔisbiriŋ]
g) /stri:t/ ‘street’→ [ʔistiriit]

Vowel epenthesis in loanword adaptation in Japanese is scrutinised by scholars including Park (1987), Shinohara (1997), Katayama (1998), Uffmann (2007). They agree that consonant clusters and coda consonants in loanwords are resolved by an epenthetic vowel /u/, unless the preceding consonant is either /t/ or /d/ where an epenthetic vowel /o/ is inserted alternatively as shown in the following examples:[3]

(3) loanword adaptation in Japanese

a) fesutibaru	‘festival’
b) disuku	‘dise’
c) zippu koodo	‘zip code’
d) jiguzagu	‘zigzag’
e) furutaimu	‘full-time’
g) arubaito	‘job’ (German *Arbeit*)

Japanese disfavors consonant clusters in English loanwords due to the restriction on its syllable structure, while this language permits closed syllables underlyingly, but codas in English loanwords are avoided by peripheral insertion, as seen in the examples above. This shows that a CV syllable is preferred when dealing with consonant clusters and coda consonants in English loanwords.

Unlike Egyptian and Japanese, Plag & Uffmann (1999) run an experiment on final vowel insertion in loanwords adaptation in Sranan language. They observe that nasal consonants are the only type of consonants permitted in the coda position underlyingly, while non-nasal codas in English loanwords are avoided by epenthetic vowels that are inserted peripherally in order to come up with a CV syllable which is unmarked universally (Blevins 1995). Consider the following examples:

[1] McCarthy (2005), Haddad (2005), and Gadoua (2000) agree on a glottal stop being preceded by an initial epenthetic vowel, because they state that words in Arabic are not onsetless, compared to other languages. Furthermore, Carter (2004) observes that words in Classical Arabic do not ever start with vowels.

[2] The first consonant, as a bilabial plosive voiceless, is substituted with a voiced one /b/, because the voiceless bilabial plosive is not found in Modern Standard Arabic in general and in modern Arabic dialects in particular, according to what most scholars of Arabic phonology stated.

[3] The affrication of /t/ and /d/ would be triggered by an epenthetic vowel [u] (Park 1987; Shinohara 1997; Katayama1998; Uffmann 2007). In other words, by inserting a vowel [u], /d/ and /t/ would be changed to [ts] and [dz].

(4) English loanwords in Sranan

English		Sranan
bed	>>	bedi
bush	>>	busi
have	>>	habi
talk	>>	taki
dog	>>	dagu

Alber & Plag (1999) adhere to Plag's and Uffmann's (1999) study on loanword adaptation in Sranan and note that vowel epenthesis is a strategy used in the adaptation of English loanwords in Sranan, as an English–based creol language spoken in Surinam, as well as deletion. The restriction on Sranan syllable structure is a motivating factor for epenthesis and deletion when dealing with English loanwords that have word-initial [s] and non-nasal codas. Although this language permits complex onsets as a word for a language itself, *Sranan*, but it disfavors syllable types that have complex onsets that start with a fricative [s] as well as non-nasal codas since CV-syllable is the most preferable syllable type in this language. Also, they refer to an Optimality Theoretic approach for the analysis of epenthesis and deletion in loanword adaptation in this language.

(5) Loanwords adaptation in Sranan

English		Sranan
speak	>>	piki
spoil	>>	pori
nose	>>	noso
top	>>	tapu
walk	>>	waka

English loanwords in Shona language are taken into consideration by Uffmann (2002) who provides an interpretation of vowel epenthesis in English loanwords with consonant clusters and coda consonants. According to him, due to the restriction on Shona syllable structure, consonant clusters and coda consonants are avoided by vowel epenthesis. Also, he adopts OT, as a framework, to analyse this phenomenon.

(6) English loanwords in Shona:

English		Shona
truck	>>	tu.ro.ko
green	>>	gi.ri.ni

wig	>>	wi.gi
map	>>	me.pu
team	>>	ti.mi

Unlike languages with CV syllables, the study of English loanwords in Dholuo is done by Owino (2003) who notes that codas motivate final vowel insertion in these words, especially monosyllabic words, even though this language allows closed syllables. According to him, the motivation for this process is that the word shape of CVCV is preferred in Dholuo. Consider the following examples:

(7) English loanwords in Dholuo

English		Dholuo
club /klʌb/	>>	[ki.la.bu]
team /ti:m/	>>	[ti.mu]
pipe /paɪp/	>>	[paɪ.pu]
map /mæp/	>>	[ma.pu]
bolt /bəʊlt/	>>	[bo.li.ti]
load /ləʊd/	>>	[lo.di]

The same behaviour is reported by Iverson& Lee (2006) with reference to Japanese language. They agree that the sanction of consonants in the coda position in Japanese syllable structure is widely well-known but under very limited conditions; i.e. when a coda consonant is assigned as the first half of a geminate or in the form of a celebrated moraic nasal; e.g., ‘Japan’ *nippon* [ni.p.po.n]. Otherwise, coda consonants are not tolerated in this language, especially those in English loanwords. Consider the following examples:

(8) Loanword adaptation in Japanese

English		Japanese
Macdonald /mæk.dɒ.nəld/	>>	[ma.ku.do.na. ɾu.do]
Part-time /pʰaɹt̚. tʰaɪm/	>>	[paa.to.tai.mu]

Abubakre (2008) who works on Hausa language lists some Arabic and English loanwords which are adapted using the strategy of vowel epenthesis, as shown in the following examples:

9) i. Arabic loanwords in Hausa

Arabic		**Hausa**
/wa.zir/ ‘minister’	>>	[wa.zi.r**i**]
/muf.ti/ ‘An assistant to a judge’	>>	[mu.f**u**.ti]

/ʔadl/ ‘justice’	>>	[ʔa.d**a**.l**i**]

ii. English loanwords in Hausa

English		Hausa
bread	>>	b**u**.ro.d**i**
doctor	>>	li.ki.t**a**
driver	>>	d**i**.re.b**a**
packet	>>	fa.ki.t**i**

The studies above show how consonant clusters along with coda consonants in loanwords are treated with reference to different languages. However, with respect to scholars who conduct these studies, the avoidance of coda consonants in Arabic loanwords in Hausa language has not been investigated yet and accounted for within OT. Therefore, there are some questions will be addressed in the next sections; what are the restrictions on syllable structure in Hausa? How codas in Arabic loanwords are treated in Hausa? Before, addressing these questions, the next section will manifest some general background knowledge about Hausa.

3. Hausa Language

This section is specific to the relevant background information about Hausa with respect to its segment inventory, vowel inventory, and syllable structures. The next subsection is to view some information about Hausa and where it is spoken.

3.1 Background of Hausa Language

Hausa language is considered to be one of the three spoken languages in Nigeria for the sake of indigeneity (Adeniyi & Bello, 2006). Based on the Summer Institute of Languages (SIL,2008), by virtue of its widespread use in Africa, it is ranked second to Swahili, as a lingua franca (Abubakre 2008). This language is spoken in northern Nigeria as well as northern Cameron and Ghana. It is also used as a commercial language in West African capital cities, some parts of Chad and Sudan, and in north and equatorial Africa. The next subsection is devoted to overview the types of vowels in Hausa.

3.2 Vowel and Consonant Inventory in Hausa

Caron (2011) reports that Hausa comprises twelve vowels; five short vowels along with their long counterparts plus two diphthongs. According to him, the five short vowels are /i/, /e/, /a/, /o/, and /u/ and their long counterparts are /iː/, /eː/, /aː/, /oː/, and /uː/, while the two diphthongs are /aɪ/ and /aʊ/. The table below shows short vowels and their long counterparts:

International Journal of Linguistics
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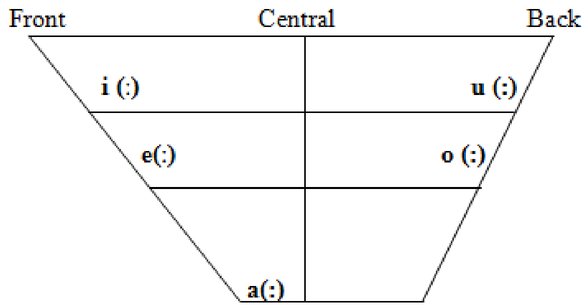
(10) Short and long vowels in Hausa

Short vowel	**Long vowel**
/i/	/i:/
/e/	/e:/
/a/	/a:/
/o/	/o:/
/u/	/u:/

(11) The chart below identifies these vowels in regarding their length and distribution:



The entire inventory of consonants in Hausa are gathered in the table below and represented conventionally by place and manner of articulation:

(12) The manner and place of articulation of consonants in Hausa:

	Bilabial	Alveolar	Post-alveolar	Palatal	Palatalized Velar	Velar	Labialized velar	Glottal
Plosives	b	t d			k^j g^j	k g	k^w g^w	ʔ
Affricate			ʧ ʤ					
Implosive	ɓ	ɗ						
Ejective stop				j’	k^j’	k’	k^w’	
Ejective Affricate		ʦ’	ʧ’					
Nasal	m	n						
Fricative	ɸ	s z	ʃ					h
Tap/Trill		r ɽ						
Approximant	w			j				
Lateral Approximant		l						

The table of manner and place of articulation of consonants in Hausa is cited from the book of International Phonetic Association (1999). The number of consonants in this table is thirty two, starting from plosives in terms of the manner of articulation and ending up with lateral approximant; plosives and affricates in Hausa are moderately aspirated in the word-initial position. Velar consonants are labialized when they are preceded by rounded vowels; e.g., [kʷo:ɽa:] *kora* 'ringworm'. The palatalized consonants come before front vowels; e.g., [kʲiːʃ́iː] kishi 'jealousy'. The palatalized velars contrast with their labialized counterparts before front vowels; e.g., [kʷi:ɓì:] 'side of body'. The glottal stop predictably occurs initially in order to avoid onsetless syllables, especially in some Arabic loanwords; e.g., aya [ʔa:jà:] 'verse'. The syllable structures are discussed in the next subsection.

3.3 Syllable Structures in Hausa

Jaggar (2001) and Caron (2011) state that syllable structures in Hausa are divided into light (CV) and heavy (CVVand CVC). Two-vowel slots in the CVV syllable are filled with a long vowel or a diphthong (Jaggar 2001):

(13) Syllable types in Hausa

Syllable type	Syllable Weight	Example	Gloss
CV	Light	[mà.cè]	'woman'
CVV	Heavy	[ʔai.**kì̄**]	'work'
CVC	Heavy	[**wây**.yō!]	'oh dear!'

Like English and German, syllabic consonants are employed as the nuclei in syllables; hence, in Hausa, Jaggar (2001) observes that the syllabic consonant /n/ functions as a nucleus; e.g., / ʔn.guwa/ 'ward/quarter' (of a city). Also, this type of consonants can represent an entire syllable (Jaggar 2001); e.g., /n.gayà̄ mâ/ 'let me tell you'.

According to Jaggar (2001) and Caron (2011), initial vowels are avoided in this language by the epenthetic glottal stop as well as Arabic; i.e., a glottal stop is inserted initially in order not to have onsetless syllables; e.g., ***aiki*** 'work' [**ʔ**ai.ki].

Jaggar (2001) states that sonoroants including /n/, /m/, /l/, and /r/ might be found in the coda position of non-final syllables as shown in the table below:

(14) Sonorants in the coda position in Hausa

Sonorants	Example	Gloss
/n/	/ha**n**. ʧì/	'nose'
/m/	/gʷa**m**.na/	'governor'
/l/	/gu**l**.ma/	'mischief-making'
/r/	/ka**r**.ja/	'break'

Like sonorants in the coda positon, Jaggar (2001) reports that fricatives /s/, /z/ can function as codas; e.g., /ka**s**.ko:/ 'small bowl', /fiz.ge/ 'grab'. Also, labial can occur in the coda position;e.g., /ta**b**.ka/ 'do a lot of', /ʧa**f**.ke/ 'snatch'.

Consonant clusters in English loanwords in Hausa are avoided by deletion and epenthesis;

International Journal of Linguistics
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2015, Vol. 7, No. 2

hence, Jaggar (2001) and Abubakre (2008) agree that internal epenthesis is used to ban initial consonant clusters in English loanwords; e.g., /breɪk/ 'break'→ [b**u**r.k**i**], /ɪŋ.glɪʃ/→ [ʔin.g**i**.li.ʃ**i**] 'English'. This behaviour is similarly found in some English loanwords in Egyptian Arabic (Broselow 1984, 1992, 1993), Japanese (Park 1987; Shinohara 1997; Katayama 1998; Iverson & Lee 2006; Uffmann 2007), Shona (Uffmann 2002), and Dholu (Owino 2003), while deletion targets the fricative voiceless /s/, as the first member of word-initial clusters, in English loanwords in Sranan (Alber , Plag, and Uffmann 1999), even though this language allows word-initial clusters (cf. the word for the language itself, *Sranan*) (see section 2) . The examples, [b**u**r.k**i**] and [ʔin.g**i**.li.ʃ**i**], reveal two notions regarding the treatment of initial consonant clusters in English loanwords and final obstruents. The internal epenthetic vowels [u] and [i] functionally split initial consonant clusters due to the restriction on Hausa syllable structure, whereas the epenthetic vowel [i] aims to avoid final obstruents.[4] In section 2, this behaviour is observed in Sranan (Alber, Plag, and Uffmann 1999) where non-nasal codas motivate paragoge (word-final epenthesis). However, Dholuo (Owino 2003) cannot tolerate codas in English loanwords regardless of the identity of consonants in the coda positon. Therefore, word-final insertion is permitted in order to achieve the word shape CVCV which is preferable in this language. Vowel epenthesis and consonant deletion are two processes determined by the members of final consonant clusters. For instance, deletion is motivated by a final consonant cluster that its members are obstruents. Therefore, the peripheral consonant undergoes deletion; e.g., /drɑ:**ft**/→ [di.raf] 'draft'. However, deletion does not target final obstruents that follow sonorants as members of final consonant clusters, whereas vowel epenthesis occurs after final obstruents for two reasons. The first reason is to ban a final consonant cluster for the sake of saitifaction of the restriction on Hausa syllable structure and the second reason is to avoid closing final syllables with obstruents; e.g., /be**nʧ**/→ [ben.ʧ**i**] 'bench', /plæ**ŋk**/→ [fi.lan.k**i**] 'plank', /pʌ**mp**/→ [fam.f**o**] 'pump', and /wɒrənt/→ [wa.ran.t**i**] 'warrant'.

At the end, the question related to the restrictions on Hausa syllable structure has been answered in this section; according to the syllable types in Hausa, initial consonant clusters are not tolerated in this language. Therefore, initial consonant clusters in English loanwords in Hausa are broken up by vowel epenthesis as well as word-initial clusters in English loanwords in Egyptian Arabic (Broselow 1984, 1992, 1993), Japanese (Park 1987; Shinohara 1997; Katayama 1998; Iverson & Lee 2006; Uffmann 2007), Shona (Uffmann 2002), and Dholu (Owino 2003). On the contrary, most word-initial clusters in English loanwords in Sranan are permitted, except initial consonant clusters that start with /s/ (Alber, Plag, and Uffmann 1999). On the other hand, word-final clusters are not allowed in Hausa. Therefore, they are avoided by paragoge or deletion, depending on the identity of these clusters. For instance, final obstruents undergo deletion if they follow obstruents, while paragoge is motivated by final obstruents that follow sonorants; e.g., /drɑ:**ft**/→ [di.raf] 'draft' , /plæ**ŋk**/→ [fi.lan.k**i**] 'plank'. Fricatives and labials function as codas as well as sonorants in non-final syllables in Hausa; e.g., /ka**s**.ko:/ 'small bowl', /fi**z**.ge/ 'grab', /ta**b**.ka/ 'do a lot of', /ka**f**.ke/ 'snatch', /ha**n**. ʧi/ 'nose', /gʷa**m**.na/ 'governor', /gu**l**.ma/ 'governor', /gu**l**.ma/

[4] Jaggar (2001:24) mentions some English loanwords in Hausa where final obstruents have been retained; e.g., /klınıık/ → [kilınıı**k**] 'clinic', /krıkıt/→ [kurıkı**t**] 'cricket', and /træ.fık/→ [tara.fi**k**] 'traffic'.

'mischief-making',and /ka**r**.ja/ 'break'. However, final obstruents in English loanwords in Hausa are avoided by paragoge; e.g., /breɪk/ 'break'→ [b**u**r.k**i**], /ɪŋ.glɪʃ/→ [ʔin.g**i**.li.ʃ**i**] 'English'. After viewing some background knowledge about the phonology of Hausa, the next section is devoted to answer the second question in this study relevant to the treatment of codas in Arabic loanwords in Hausa. In other words, epenthesis is demonstrated in the next section as a repair strategy for Arabic loanword adaptation with special reference to Hausa. Furthermore, since Arabic loanwords in Hausa have not been addressed within OT, as a framework, the next section shows how this framework is used to account for this adaptation using some faithfulness and markedness constraints that are universally known.

4. Arabic Loanword Adaptation in Hausa and Optimality Theory

In section 2, the loanword adaptations in languages depend on two repair strategies; i.e. vowel epenthesis and consonant deletion, while in English loanword adaptation in Hausa is done by epenthesis and consonant deletion. Vowel epenthesis is motivated by initial consonant clusters, final sonorant plus obstruent cluster, and single obstruent codas, while deletion targets final obstruent clusters where the peripheral obstruents are deleted. However, the Arabic loanword adaptation in Hausa is somehow different from English one; hence, vowel epenthesis is mostly used to avoid codas, whereas vowel shortening is employed to reduce long vowels. On the other hand, coda deletion targets final syllables that close with /h/, as a fricative voiceless consonant. These phenomena are discussed in detail in this section. First, we will start with vowel epenthesis as the most common repair strategy used in Arabic loanword adaptation in order to avoid complexity codas. Consider the following examples below:

(15) Arabic loanwords of the form CVCC in Hausa

a. /dars/→ [da.r**a**.s**i**] 'a lesson'
b. /ħarf/→ [ha.r**a**.f**i**] 'a letter'
c. /ʤamʕ/→ [ʤam.ʔ**i**] 'plural form'

The examples in (15) reveal the fact the final consonant clusters in Arabic loanwords are broken up by vowel epenthesis. This statement finds a support in Abu Bakre's (2008) who mentions that final consonant clusters in Arabic loanwords are adapted by vowel epenthesis. She also gives an example of the output of /ʔadl/ 'justice' where vowel epenthesis occurs twice in order to break up a final consonant cluster and to avoid codas; i.e. /ʔadl/ 'justice' →[ʔa.d**a**.l**i**]. It is clear that the avoidance of consonant clusters is due to restriction on syllable structure, according to Cain (1986), Park (1987), Alkinlabi (1993), Mwihaki (2001), Uffmann (2002,2005), Kenstowicz (2007), Adomako (2008), and Repetti (2012). On the other hand, most single codas motivate vowel epenthesis, except a nasal coda /m/ in a non-final syllable, as in the output [ʤam.ʔ**i**] 'plural form'. Hausa behaves similarly to Dholu (Owino 2003) and Sranan (Alber , Plag, and Uffmann 1999). The motivation for vowel epenthesis after most single codas is due to the word shape CVCV being preferred in Hausa, even though Hausa allows closed heavy syllables of the form CVC. Like Sranan, there is a restriction on the type of consonants in coda position in Hausa when dealing with Arabic loanwords; hence, a nasal /m/, as a single consonant is accepted in a non-final syllable. These phenomena are accounted for within OT. The OT constraints are listed below:

(16) OT constraints:

a) ONSET (ONS) (Prince and Smolensky 2008):
Syllables must have onsets.
b) *COMPLEX(Prince and Smolensky 2008)
No more than one C or V may associate to any syllable position node.
c) MAX (McCarthy & Prince 1995):
Every segment of S_1 has a correspondent in S_2.
d) DEP (McCarthy & Prince 1995):
Every segment of S_2 has a correspondent in S_1 (S_2 is “independent on” S_1).
e) *CODA (Prince and Smolensky 2008):
Syllables must not have codas.
f) *FINAL-C
This constraint prohibits a prosodic word from ending in a consonant.

In the next tableaux, the candidates of the input /dars/, /ħarf/, and /ʤamʕ/ undergo the evaluation by the above constraints:

(17) ONS>>*COMPLEX>>*FINAL-C>>MAX>>DEP>>*CODA

/dars/	ONS	*COMPLEX	*FINAL-C	MAX	DEP	*CODA
a. dars		*!	*			**
☞ b. da.ra.si					**	
/ħarf/						
a. ħarf		*!	*			**
☞ b. ħa.ra.fi					**	
/ʤamʕ/						
a. ʤamʕ		*!	*			**
☞ b. ʤam.ʔi					*	*

The outputs [da.ra.si], [ħa.ra.fi], and [ʤam.ʔi] are identified as optimal candidates of the inputs /dars/, /dars/, /ħarf/, and /ʤamʕ/ since they avoid the violation of highly-ranked constraints including ONS,*COMPLEX,*FINAL-C, whereas the constraints *COMPLEX and *FINAL-C are subjects to violations by the outputs [dars], [ħarf], and [ʤamʕ], even though these outputs are faithful to the input, compared to optimal candidates. Final consonant clusters in these outputs violate the *COMPLEX constraint, while the peripheral consonants violates the *FINAL-C.

On the other hand, a single coda in a CVVC form is avoided by paragoge with shortening of a hollow verb, except a diphthong. Consider the following examples;

(18) Arabic loanwords of the form /CVVC/

a) /baab/→ [ba.bi] ‘chapter’
b) /bait/→ [bai.ti] ‘house’

International Journal of Linguistics
ISSN 1948-5425
2015, Vol. 7, No. 2

c) /ħaal/→ [ha.li̲] ‘condition or character’

It is clear from the examples in (18) that single codas are resyllabified as onsets of the following syllables where epenthetic vowels are employed as their nuclei. Long vowels are shortened, except in the output [bai.ti̲] where a dipthong is immune to vowel shortening. The OT constraints in (16) are to evaluate the candidates of the input /baab/, /bait/, and /ħaal/.

(19) ONS>>*COMPLEX>>*FINAL-C>>MAX>>DEP>>*CODA

/baab/	ONS	*COMPLEX	*FINAL-C	MAX	DEP	*CODA
a. baab		*!	*			*
☞b. ba.bi̲				*	*	
/bait/						
a. bait		*	*!			*
☞ b. bai.ti̲		*			*	
/ħaal/						
a. ħaal		*!	*			*
☞b. ha.li̲				*	*	

In the first tableau, the output [ba.bi̲] is identified as an optimal candidate of the input /baab/ due to the avoidance of the violation of the constraints *COMPLEX and *FINAL-C, whereas the output [baab] fails to satisfy these constraints, even though it more faithful to the input that [ba.bi̲]. As a result, this output is eliminated from being optimal. In the second tableau, the output [bait] fails to be optimised because it violates the constraint *FINAL-C. As a result, the output [bai.ti̲] is distinguished as an optimal output. The output [ha.li̲] is successfully discriminated as an optimal candidate since it satisfies the constraints *COMPLEX and *FINAL-C. On the contrary, these constraints are subject to violations by the output [ħaal] since this output has a long vowel and ends with a consonant.

On the other hand other single codas in disyllabic words are resyllabified as onsets of the newly created syllables where epenthetic vowels are employed as nuclei:

(20) Words of the form /CV.CVC/

a) /ʔa.dab/ → [ʔa.da.bi̲] ‘literature’

b) /ka.fir/→ [ka.fi.ri̲] ‘misbeliever’

c) /ħa.kim/→ [ha.ki.mi̲] ‘district head’

d) /wa.zir/ → [wa.zi.ri̲] ‘minister’

e) /ʔi.man/→ [ʔi.ma.ni̲] ‘faith’

f) /tˤa.lib/→ [tʰa.li.bi̲] ‘student’

g) /wa.ʤib/→ [wa.ʤi.bi̲] ‘Obligatory’

h) /χa.raʤ/→ [ha.ra.ʤi̲] ‘poll tax’

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In spite of the identity of consonants in the coda position of final syllables, word-initial epenthesis (paragoge) is provoked by single codas in final syllables in order to achieve the final CV syllable as a preferable form in Hausa. This behaviour is accounted for within OT; the candidates of the inputs /ʔa.dab/, /ka.fir/, /ħa.kim/, and /wa.zir/are evaluated in the next tableaux:

(21) ONS>>*COMPLEX>>*FINAL-C>>MAX>>DEP>>*CODA

/ʔa.dab/	ONS	*COMPLEX	*FINAL-C	MAX	DEP	*CODA
a. ʔa.dab			*!			*
☞b. ʔa.da.b**i**					*	
/ka.fir/						
a. ka.fir			*!			*
☞b. ka.fi.r**i**					*	
/ħa.kim/						
a. ħa.kim			*!			*
☞b. ħa.ki.m**i**					*	
/wa.zir/						
a. wa.zir			*!			*
☞b. wa.zi.r**i**					*	

The tableaux above show that candidates where the prosodic words end with consonants are not identified as optimal outputs due to the violation of the *FINAL-C constraint. For instance, in the first tableau, the output [ʔa.da.b**i**] allows paragoge in order to avoid the violation of the *FINAL-C, as a highly-ranked constraint. Therefore, this output becomes an optimal candidate. Likewise, for the sake of satisfaction of the *FINAL- C constraint, the outputs [ka.fi.r**i**], [ħa.ki.m**i**], and [wa.zi.r**i]** in the following tableaux behave similarly by the permission of paragoge.

Non-final codas in disyllabic words of the form /CVC.CV/ are avoided by vowel epenthesis in Arabic loanwords in Hausa, especially if a coda is not a bilabial nasal stop /m/, as shown in the examples below:

(22) Arabic loanwords of the form /CVC.CV/

a) /raʃ.wa/→ [ra.ʃ**a**.wa] 'bribe'

b) /don.ja/→ [du.n**i**.ja] 'world'

c) /qah.wa/→[ga.h**a**.wa] 'coffee'

In the next tableau, the candidates of the input /raʃ.wa/ 'bribe' will be evaluated with the same set of constraints:

(23) ONS>>*COMPLEX>>*FINAL-C>>MAX>>DEP>>*CODA

/raʃ.wa/	ONS	*COMPLEX	*FINAL-C	MAX	DEP	*CODA
☞ a. raʃ.wa						*
b. ra.ʃ**a**.wa					*!	

Unfortunately, the desired output [ra.ʃ**a**.wa] could not become optimal due to the violation of DEP, while the wrong output [raʃ.wa] escapes from the violation of the same constraint by being blocking paragoge. This finding leads to idea that this set of constraint is not helpful in this case . Therefore, there should be a constraint that can help the desired output [ra.ʃ**a**.wa] to become optimal. By scrutinizing the wrong output [raʃ.wa], there is rising sonority across the syllable boundary because the glide [w] is more sonorous that a fricative [ʃ]. Accordingly, the following constraint can do this job:

(24) Syllable Contact (SYLLCON) (Bat El 1996:302):

The onset of a syllable must be less sonorous than the last segment in the immediately preceding syllable, and the greater the slope in sonority the better.

The constraint (24) is added to the set of constraints in (14) and it is ranked higher than the MAX constraint.

(25) ONS>>*COMPLEX>> *FINAL-C>> SYLLCON >>MAX>>DEP>>*CODA

/raʃ.wa/	ONS	*COMPLEX	*FINAL-C	SYLLCON	MAX	DEP	*CODA
a. raʃ.wa				*!			*
☞b. ra.ʃ**a**.wa						*	

The output [raʃ.wa] fails to be optimal due to the violation of the SYLLCON constraint where sonority rises across a syllable boundary. Otherwise, this violation is avoided by vowel epenthesis in the desired output [ra.ʃ**a**.wa]. The set of constraints in (25) is used in the next tableau to evaluate the candidates of the input /don.ja/ ‘world’:

(26) ONS>>*COMPLEX>> *FINAL-C>> SYLLCON >>MAX>>DEP>>*CODA

/don.ja/	ONS	*COMPLEX	*FINAL-C	SYLLCON	MAX	DEP	*CODA
a. don.ja				*!			*
☞b. du.n**i**.ja						*	

The set of constraints in (26) selects the desired output [du.n**i**.ja] as the optimal candidate of the input /don.ja/ due to the satisfaction of the SYLLCON constraint, whereas the same constraint is violated by the output [don.ja]. In other words, rising sonority in the output [don.ja] results from having the nasal stop [n] and the glide [j] being split by the syllable boundary. As a result, this rising violates the SYLLCON constraint. On the other hand, the candidates of the input /qah.wa/ ‘coffee’ are evaluated in the next tableau:

(27) ONS>>*COMPLEX>> *FINAL-C>> SYLLCON >>MAX>>DEP>>*CODA

/qah.wa/	ONS	*COMPLEX	*FINAL-C	SYLLCON	MAX	DEP	*CODA
a. qah.wa				*!			*

☞b. ga.h<u>**a**</u>.wa	*	*

The output [ga.h<u>**a**</u>.wa] is shown in the tableau above as the optimal candidate of the input /qah.wa/ due to the avoidance of the violation of the SYLLCON constraint. This constraint is being a subject to violation by the output [qah.wa], even though this output is more faithful to the input than the output [ga.h<u>**a**</u>.wa]. Consequently, this output fails to be optimised.

After illustrating the Arabic loanwords adaptation of the form /CVC.CV/, vowel epenthesis and final consonant deletion are two processes are dealt with when adapting Arabic loanwords of the form /CV<u>C</u>.CV<u>C</u>/, depending on the identity of consonants that represent codas in both syllables. For instance, some Arabic loanwords are adapted by using vowel epenthesis plus final consonant deletion, while others are adapted by final consonant deletion without seeking for vowel epenthesis and vice versa. Consider the following examples:

(28) Arabic loanwords of the form /CVC.CVC/

a) /madʒ.lis/→ [ma.dʒ<u>**a**</u>.li.s<u>**a**</u>] ‘council’

b) /dʒum.lah/→ [dʒum.la] ‘ a sentence’

c) /bid.ʕah/→ [bi.d<u>**i**</u>. ʔa] ‘Merriment’

In (28), the Arabic loanword /madʒ.lis/ is adapted in Hausa by the repair strategy of vowel epenthesis in order to achieve the output [ma.dʒ<u>**a**</u>.li.s<u>**a**</u>]. Clearly, the restriction on syllable structure is not applied on the skeletal shape CVC since Hausa itself permits syllables of the form CVC. Like Dholuo (Owino 2003), the word of the shape CV is preferred in Hausa. Final consonant deletion is alternatively used in the adaptation of the word /dʒum.lah/ where the medial nasal /m/ is perserved as a coda of the non-final syllable while /h/, as a coda of the final syllable, undergoes deletion.[5] The same final /h/ undergoes the deletion in the adaptation of the input /bid.ʕah/, whereas /d/ as a coda of the non-final syllable is resyllabified as an onset of the following syllable where an epenthetic vowel [i] is employed as its nucleus; i.e. /bid.ʕah/→ [bi.d<u>**i**</u>. ʔa] ‘Merriment’. By virtue of OT analysis, the outputs of /madʒ.lis/ are evaluated in the next tableau:

(29) ONS>>*COMPLEX>> *FINAL-C>> SYLLCON >>MAX>>DEP>>*CODA

/madʒ.lis/	ONS	*COMPLEX	*FINAL-C	SYLLCON	MAX	DEP	*CODA
a. madʒ.lis			*!	*			*
☞b. ma.dʒ<u>**a**</u>.li.s<u>**a**</u>						**	

The tableau above disriminates the output [madʒ.lis] as an optimal candidate because it satisfies the constraints *FINAL-C and SYLLCON. These constraints are subject to violation by the output [madʒ.lis]. Therefore, this output cannot be determined as an optimal output. In the next tableau, the candidates of the input /dʒum.lah/ undergo the evaluation in order to determine [dʒum.la] as an optimal candidate:

(30) ONS>>*COMPLEX>> *FINAL-C>> SYLLCON >>MAX>>DEP>>*CODA

[5] The nasal /m/ is preserved as a coda of a non-final syllable in [dʒum.la] as well as in [dʒam.ʔ<u>**i**</u>].

/ʤum.lah/	ONS	*COMPLEX	*FINAL-C	SYLLCON	MAX	DEP	*CODA
a. ʤum.lah			*!	*			**
☞b. ʤum.la				*	*	*	*

The output [ʤum.la] allows final consonant deletion in order to satisfy the constraint *FINAL-C. As a result, this output is determined as an optimal candidate, whereas the output [ʤum.lah] perserves the final consonant of the prosodic word but it fails to escape from the violation of the *FINAL-C constraint. The next tableau shows the evaluation of candidates of the input /bid.ʕah/.

(31) ONS>>*COMPLEX>> *FINAL-C>> SYLLCON >>MAX>>DEP>>*CODA

/bid.ʕah/	ONS	*COMPLEX	*FINAL-C	SYLLCON	MAX	DEP	*CODA
a. bid.ʕah			*!	*			*
☞b. bi.d**i**. ʔa					*	*	

The tableau above identifies the ouput [bi.d**i**. ʔa] as an optimal candidate since it avoids the violation of the *FINAL-C constraint through the deletion of the final obstruent that closes the prosodic word. Also, the same output avoids the violation of the SYLLCON constraint by the permission of vowel epenthesis after [d] in order to block rising sonority across the syllable boundary, whereas the output [bid.ʕah] blocks epenthesis and deletion. This blockage results in the violation of the constraints *FINAL-C and SYLLCON. Therefore, this output is not qualified to be optimal.

5. Conclusion

This paper has addressed two main questions; what are the restrictions on syllable structure in Hausa? How codas in Arabic loanwords are treated in Hausa? According to the first question, codas of non-final syllables can be sonorants, the fricatives /s/ and /z/, or labials like /f/, and /b/. Word-initial clusters in English loanwords are broken up by vowel epenthesis in Hausa due to the restriction on Hausa syllable structure. In other words, Hausa allows CVC, as the maximum syllable structure. Therefore, English loanwords are adapted in Hausa using the repair strategy of vowel epenthesis. Likewise, this language adapts English loanwords with word-final clusters using either a final consonant deletion or paragoge, depending on the identity of the members of these clusters. For instance, if the members of word-final clusters are obstruents, then the second member is targeted by deletion; e.g., /drɑ:**ft**/→ [di.raf] ‘draft’. Paragoge is motivated by the word-final clusters in some English loanwords where the first member is a sonorant and the second member is an obstruent; e.g., /be**nʧ**/→ [ben.ʧ**i**] ‘bench’. On the other hand, single codas in final syllables motivate paragoge if they are obstruents; e.g., /breɪ**k**/ ‘break’→ [b**u**r.k**i**]. This is seen that the adaptation in English loanwords mainly relies on two strategies; i.e. vowel epenthesis and final consonant deletion.

According to the second question in this paper, vowel epenthesis is mainly used as a repair strategy of Arabic loanwords adaptation in Hausa, while consonant deletion is used for avoiding /h/ that represents a coda of a final syllable and a long vowel /a:/ is targeted by vowel shortening; e.g., /bid.ʕah/→ [bi.d**i**. ʔa] ‘Merriment’, and /ħaal/→ [ha.l**i**]. Vowel epenthesis, as a main strategy, is functionally used to break up final consonant clusters in Arabic loanwords due to the restriction on Hausa syllable structure. It is also used to avoid single codas in final and non-final syllables, except if the single coda is /m/; e.g., /ʤamʕ/→ [ʤam.ʔi] 'plural form', and /ʤum.lah/→ [ʤum.la] 'a sentence'. This part ends up with the OT analysis of Arabic loanword adaption in Hausa.

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