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AN OT APPROACH TO LOANWORD ADAPTATION IN CAIRENE ARABIC

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Abstract: Cairene Arabic (CA) elects epenthesis as a strategy for adapting loanwords. This paper tackles the reasons why this occurs as well as the different aspects of vowel epenthesis within the framework of Optimality Theory (OT)(McCarthy and Prince, 1993;Prince and Smolensky, 1993) and the relevant literature. This research specifically focuses on loanwords introduced into CA from English. It is shown that OT neatly accounts for vowel epenthesis in loanwords in CA, proving that the attested optimal forms are the result of the conflict between faithfulness and markedness. It is also proven that loanwords are modified according to the productive phonological processes of CA i.e. L1 constraints. The special case of s+obstruent blocking effect is discussed universally and with special reference to CA.

1 Introduction

There has always been an interest in the different phonological processes involved in adapting loanwords to transform into well-formed words in the borrowing language. Deletion, epenthesis and suprasegemental changes are among the processes that occur in this phonological phenomenon. These strategies were called repairs (Paradis and La Charité 1997) due to their transforming effects. Languages opt for one repair strategy or another depending on various phonological reasons. Cairene Arabic (CA) elects epenthesis as a strategy for adapting loanwords. The reasons why this occurs and the different aspects of epenthesis as a loanword repair strategy are dealt with in this paper within the framework of Optimality Theory (OT) initiated by McCarthy and Prince (1993) and Prince and Smolensky (1993). Loanwords introduced into Arabic from English are the focus of the research.

This paper accounts, within the framework of OT, for the adaptation of loanwords introduced into Cairene Arabic (CA) from English in terms of vowel epenthesis. In particular, three main points are analyzed.

(1) a. The constraints responsible for vowel epenthesis in general, i.e. epenthesis vs. deletion as a strategy opted for by CA;
b. The determinants of the position of epenthetic vowel in terms of OT constraints;

c. The factors Accounting for the quality of the epenthetic vowels, particularly why some vowels are selected for the purpose of epenthesis rather than others.

This work shows that OT neatly accounts for loanword adaptation strategies in terms of vowel epenthesis employed by CA, proving that the attested optimal forms are the result of this conflict between faithfulness and markedness, thus lending further evidence to the validity of the universality of this dichotomy proposed by the theory. The fact that all constraints interact by ranking in one way or another is an indication of the capacity of the theory to achieve functional unity. One more reason to motivate this study is that, to my knowledge, no previous studies have been done on loanword adaptation in Cairene Arabic (CA).

The organization of the paper goes as follows. Two main sections are provided: a data section and an analysis section. The data section presents the actual items under study, describes them and abstracts some generalizations. The analysis section analyzes the data and motivates the constraints for vocalic epenthesis in terms of three main points mentioned above.

2 Data, Description and Generalization

The data under study are all from CA (Afro-Asiatic, Semitic). Most of the items are collected from Hinds and Badawy (1986). However, being involved in the process of ESL teaching I added items (f) and (i) in data (2) from my personal communication with native speakers.

(2) Different positions of the epenthetic vowel

Arabic	**English**
a.firizar	freezer
b.biristul	bristol
c.birinter	printer
d.kirimbilin	Crimplene
e.ʔistiryu	stereo
f.ʔisbiitʃ	speech
g.ʔisbireeh	spray
h. bankinut	banknote
i.ʃarkiskiin	shark skin cloth
j.bustiman	postman

(3) Variation in the quality of epenthetic vowel

Arabic	**English**
a.**u**rujiktur	projector
b.**u**lurusint	florescent
c.**u**ruut	fruit
d.guruub	group
e.kalatʃ	clutch
f.filæʃ	flash
g.kilæsh	clash
h.ʔistɑf	staff
i.ʔistuk	stock
j.ʔistub	stop

The data presented are adapted forms of originally English words used in the common speech of the population of Cairo and its adjacent provinces.

Data (2) includes all cases that show different positions of the epenthetic vowel. In (a-d), epenthetic [i] occurs cluster internally (between [f] and [r] in (a), [b] and [r] in (b-c), [k] and[r] in 4(d)). In (e-g) the epenthetic vowel takes another position and occurs cluster externally (before [st] in (e), and before [sb] in (f-h)). So, there are two main positions for the epenthetic vowel, either cluster internally or cluster externally. The last three items, (h-j), are cases where CCC cluster occurs; the position of the epenthetic vowel is always after the second consonant of the cluster: (..nkin..,.. rkis..,..stim.. in bankinut, ʃarkiskiin, bustiman respectively)

Data (3) mainly includes the items that show variation in the quality of epenthetic vowel. So, in (a-d) the epenthetic vowel is [u]; in (e) it is [ɑ] and in (f-j), it is [i]. It is clear from the data in this set that there is a full correspondence in quality between the epenthetic vowel (in bold) and the immediately following vowel in (a-d) (the epenthetic vowel [u] is a copy of the immediately following vowel). In items (f-j) such correspondence is only partial; the case does not involve copying, unlike (a-d), though there are similarities between both in terms of certain phonological dimensions. (This will be explained in the analysis part).

If we may make generalization here it is possible to tentatively say that epenthesis could be the result of phonotactic constraints ranked differently in CA and English. The rules of CA in (4) would help us figure out why epenthesis occurs:

(4) a. No word initial clusters allowed

b. A maximum of two consonants may occur in word final position.
c. A maximum of two consonants may occur word medially
d. No initial vowels (except in morphophonemic alternation)
e. The canonical syllable type is CV(C).

In the analysis part we will see that loan words get adapted to fit the phonotactics of syllable structure in CA and that epenthesis is introduced in the language to satisfy constraints on phonotactics and syllable structure in the borrowing language.

Given the data at hand it could be roughly said that CA seems to show a preference for epenthesis over deletion, so it is predicted that: MAX » DEP[i]. We can read from the data that complexity of the onset is strictly forbidden so that * COMPLEX^{ONS} is predicted to be at play. The data also has a preference for ONSET. There has to be an onset; where this does not exist, the epenthetic glottal stop [ʔ] is provided[ii] .The glottal stop saves the ONSET constraint in CA. These are just some preliminary observations about the data .The constraints will be explained and defined and their interactions will be illustrated in the following analysis section.

3 An OT Analysis

In this part, I will show how constraints work and interact in order to account for the various facts about epenthesis as a strategy in loanword adaptation. Three main issues will be dealt with here: constraints for vowel epenthesis vs. deletion as a strategy opted for by CA; different positions of the epenthetic vowels; the determinants of the quality of epenthetic vowel. Before starting our analysis a note about the choice of input items has to be taken into consideration. I devote the following sub-section to discussing this issue.

Input

It is taken for granted that both Arabic and English have their own sound inventories, as evident from tables1- 4. It is normal in the process of loanword adaptation involved here to see a mapping of English sounds into their counterparts in Arabic. The vowel inventory in CA, according to Gary and Gamal El-din (1982), includes:

(5) a. short vowels: /i/, high front; /u/ high back rounded; /ɑ/ lowback.unrounded
b. long vowels (with short counterparts):/i: /, /u: /, /ɑ: /.
c. long vowels (without short counterparts):/e:/front, -high, -low; /o:/back round, -high, -low.

As for consonants, all English consonant sounds are included in the Arabic inventory except /p/ sound which has only a voiced counterpart in Arabic/b/ (See tables I-IV for comparison). However if there is a mismatch between English and Arabic sounds, the closest sound in the borrowing language is picked out. The word [ʔistub] (borrowed from English "stop") exemplifies this. The fact that Arabic lacks the sound /ɒ /(assuming that CA got this loanword in its British English pronunciation) the phonological system of Arabic picks out /u/ as the closest available alternative sound in the inventory in terms of shortness and roundness. Because Arabic has no /p/ the available alternative is /b/. This process works systematically for the loanwords. The scope of this study goes beyond this one -to- one mapping of sounds between the loaning language and the borrowing one. The study will be limited to vowel epenthesis as a strategy for repairing the loaned words to fit the constraints of CA. I will take the words nativized before epenthesis occurs to be the input, though it is my belief that sound mutation and epenthesis occur simultaneously. Based on the previously mentioned example, /stub/ will be taken to be the input for [ʔistub].

Manner ↓ / Place→	Labial	Labio dental	Interdental	Dental: Plain	Dental: Emphatic	Post-alveolar	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	b			t d	T D			k g	q		ʔ
Fricative	f		θ	s z	S Z	ʃ ʒ		X ɣ		ħ ʕ	h
(Central) approximant	w					r	j				
(Lateral) approximant				l							
Nasal	m					n					

Table I Consonant inventory of CA based on (Gary and Gamal –El-din, 1982)

Manner ↓ / Place→	Bilabial	Labio dental	Dental	Alveolar	Palato-alveolar	Palatal	Velar
Plosive	P b			t d			k g
Fricative		f v	θ ð	s z	ʃ ʒ		
(Central) approximant	(w)			r		j	w
(Lateral) approximant				l			
Nasal	m			n		y	ŋ

Table II Consonant inventory of English (Ladefoged, 2001)

	Front		Central		Back			
					Rounded		Unrounded	
	Tense	lax	Tense	lax	Tense	lax	Tense	lax
High	i, ii				u, uu			
Mid	ee				oo			
Low							a^{iii}, aa	

Table III Vowel inventory of Arabic based on (Gary and Gamal –El-din, 1982)

	Front		Central		Back			
					Rounded		Unrounded	
	Tense	lax	Tense	lax	Tense	lax	Tense	lax
High	i	ɪ			u	ʊ		
Mid		ɛ	ɜ, ɝ	ə, ɚ	ɔ			ʌ
Low		æ				ɒ	ɑ	

Table IV Vowel inventory of English (AME, BRE) based on (Roca and Johnson, 1999)

Constraints for the Strategy of Vowel Epenthesis vs. Deletion

First and foremost, since CA doesn't allow a CC cluster to occur syllable initially we need a constraint that disallows clustering syllable initially. This constraint is:

(6) *COMPLEX ^{ONS} : complex onsets are not allowed.

Note here that the main strategy applied by CA is to epenthesize using a vowel to break the complex onset in one of the two following ways. Either to epenthesize before the cluster pushing it to a medial position, e.g. ?istiryu, ?isbireeh, ?istub. Or alternatively epenthesis occurs internally by breaking up the cluster, e.g. firiizar, fulurusint, filaʃ. Both strategies involve one main goal, which is to avoid complex onset. However, if this is the only goal, the epenthesis of vowel is enough to satisfy it. The fact that glottal stop will have to be further epenthesized shows that a syllable starting with V is not allowed in CA. CA does not allow vowels to occur syllable initially. The constraint required is:

(7) ONS: Syllables must have onsets.

Since both *COMPLEX ^{ONS} and ONS are extremely crucial for the syllable structure of CA syllable, I'd suggest they must be equally ranked. ONS is always in conflict with another constraint that requires all underlying material to be filled, in the sense that it disallows the addition of any epenthetic segments. This

constraint is DEP-IO, having the effect of blocking epenthesis. This constraint is defined as:

(8) DEP-IO : Output segments must have input correspondents (No epenthesis)

(McCarthy &Prince, 1995)

Since CA prefers providing onsets rather than militating against epenthesis, ONS must dominate DEP-IO: ONS>> DEP-IO. This ranking is necessary since onsetless forms are not attested in the language, hence epenthesis normally occurs. The fact that CA assumingly has two strategies available to observe the constraints ONS and *COMPLEX ^{ONS} , either to epenthesize or to delete and it opts for epenthesis means that deletion ranks higher in the language than epenthesis. The constraint militating against deletion is MAX-IO: Input segments must have output correspondents (McCarthy &Prince, 1995).

This means MAX-IO>> DEP-IO. Since no violation of MAX-IO is allowed, it should rank as high as *COMPLEX ^{ONS} and ONS. The ranking, so far, should go as:

(9) *COMPLEX ^{ONS}, ONS, MAX-IO >> DEP-IO

This is evidenced by the tableau in (10).

(10)

stub	ONS	*COMPLEX ^{ONS}	MAX-IO	DEP-IO
a-☞?is.tub				*
b- is.tub	*!			*
c- stub		*!		

However, words with medial cluster pose a problem for this ranking; it seems we are in need of one more constraint (or expand one of the current constraints to disallow this structure). Let's take, for example, the word *bankinut* 'banknote'. The previous constraints would predict that *ban.ki.nut* and *bank.nut* are both grammatical forms, contrary to facts in the language according to which only the former is attested .The situation is represented by the following tableau.

(11)

banknut	ONS	*COMPLEX ^{ONS}	MAX-IO	DEP-IO
a- ban.ki.nut				*
b- bank.nut				*

The fact that (b) in (11) has a complex coda does not exclude it , since it is perfectly possible for the language to have complex codas. What, then, would invalidate the form (b)? As pointed out in the generalization section, the cluster CCC is not allowed in CA even if the cluster syllabifies into separate syllables. So, we either need a new constraint that disallows CCC cluster or to stretch the

already-in-use constraint *COMPLEX so that it would go beyond disallowing complex onset to disallow CCC structure anywhere whether on the word level or phrase level. For the sake of economy and to avoid redundancy, I will opt for the latter option and redefine * COMPLEX as follows:

(12) Complex onsets and CCC clusters are not allowed.[iv]

From now on, * COMPLEX acts as a cover constraint for complex onsets and CCC clusters. This will militate against (b) in favor of (a) as illustrated by the tableau in (13).

(13)

bank.nut	ONS	*COMPLEX	MAX-IO	DEP-IO
☞a- ban.ki.nut				*
b- bank.nut		*!		

The ranking for this part, then, is:

(14) *COMPLEX, ONS, MAX-IO >> DEP-IO

Different Positions of Epenthesis within the Cluster

CCC Cluster: Some important patterns are worth considering here. CA allows a maximum of two-consonant clusters to occur word-medially, where the first of the two consonants closes one syllable and the second releases the second. However CCC cluster is not allowed in CA. There are two logical solutions to avoid the occurrence of this complex cluster: either CVC.C where a vowel is epenthesized following the first C; or, alternatively C.CVC. What would determine the position of the epenthetic vowel? The attested form in the language uses the latter pattern. Thus, it looks like the pattern in the language is to align syllables as close as possible to the right edge of the prosodic word. This constraint is ALIGN- σ:

(15) Align (σ, R, PrWd, R) (Mester and Padget, 1993)
Align right edge of every σ with R edge of some prosodic word.

This constraint is in conformity with the Generalized Alignment adopted by McCarthy and Prince (1993). The constraint in (15) handles the placement of the epenthetic vowel after the second of three consonants, thus bringing the syllable edge closer to alignment with the right edge of prosodic word.

(16)

bank.nut	ONS	*COMPLEX	MAX-IO	DEP-IO	ALIGN- σ σ 1 σ2 σ3
☞a-ban.ki.nut				*	-, μμ, μμμ
b- ba.nik.nut				*	-, μμ, μμμμ!

Since ALIGN – σ is a gradient constraint; it is always violated and must rank with the sub-ranked DEP-IO. In (16), the decisive element in making (a) the optimal form is the alignment constraint. While σ3 in (b) is four moras away from the right edge, its counterpart in (a) is only three moras and, so, it wins. Remember that since the alignment is to the right edge, σ 1 is the rightmost. Ranking so far goes as:

(17) *COMPLEX, ONS, MAX-IO, >> DEP-IO, ALIGN- σ

Before we bring this subsection to a close, a little excuesion is in place here. There could be some similarity between ALIGN- σ and the constraint CONTIGUITY (which will be introduced and defined in subsection (3.3.2)) in their ultimate effect. However, CONTIGUITY is basically intended to keep elements adjacent in the input also adjacent in the output. If we use CONTIGUITY instead of ALIGN- σ in tableau (16), we would not be able to account for why candidate (a) is the optimal. Both candidate (a) and (b) would incur the same violation of CONTIGUITY. See (3.3.2) for more details.

A final, and perhaps necessary, note here is that counting by syllables rather than moras would not show why (a) wins in (16) since both candidates (a and b) have the same number of syllables but different number of moras. In the following sub-section I discuss the rising and falling sonority clusters.

Rising and Falling Sonority Clusters: In the case of a falling sonority cluster such as [s+obstruent], epenthesis occurs before the cluster; in the case of such rising sonority clusters as [fr], epenthesis occurs internally between [f] and [r]. How to account for this? In fact, the split epenthesis pattern is pervasive in many unrelated languages, from Hindi to Wolof. In rising sonority clusters, a vowel is inserted between the two consonants of the onset as in (18) [v]

(18) Rising sonority: internal epenthesis

Hindi	firut	'fruit'
Bengali	gelaʃ	'glass'
Central Pahari	silet	'slate'
Sinhalese	tiyage	tyage 'gift' (Sanskrit)
Wolof	kalas	'class'

In falling sonority clusters, most notably s-obstruent clusters, the vowel is inserted before the cluster, as shown in (19).

(19) Falling or flat sonority: edge epenthesis

Hindi	iskul	'school'
Bengali	iʃkul	'school'
Central Pahari	ispiitʃ	'speech'
Sinhalese	istri	stri 'woman'(Sanskrit)
Wolof	estati	'statue'

Broselow (1983, 1992) is of the view that there is something special about s-obstruent clusters that makes them so distinct from other clusters, namely their structure. S-obstruent clusters are complex segments and so too hard to be broken up by epenthesis. In fact she argues that s-stop clusters are exceptional, they do not permit cluster internal epenthesis in CA. This exceptionality was ascribed to two main reasons; one is related to interference from the morphology of CA and the other to some universal complexity of s-obstruent. The verbal prefix –ista (which has the meanings of 'want', 'claim' among others) is prevalent in the morphology of CA as exemplified by the words in (20):

(20) ʔistaʔzin : 'he asked to be excused.'
ʔistaʔsid : 'he claimed to be courageous.'
ʔistafham : 'he wanted to understand.'
ʔistahbil: 'he claimed to be an idiot.'

So, the fact that epenthesis occurs cluster –externally, rather than cluster-internally, in this case, could be ascribed to interference from first language, CA. In other words the speakers associate the L1 s+t with the L2 s+t. She also claims that, by analogy, all other s-stop clusters follow suit (s+p, s+k etc.).
Broselow also states that s-stop clusters are actually exceptional in English as well. They are the only syllable –initial clusters which violate the principle that segments within the syllable tend to be arranged in a sonority sequence. Segments rise in sonority as they approach the nucleus and they fall towards the syllable margin according to the following sonority scale:

(21) stops-fricatives-nasals-liquids-glides-vowels
least sonorous most-sonorous

s-stop clusters are not only exceptional in that .They are the only clusters in English that may be followed by a third consonant and the only two-consonant clusters that may have an obstruent as their second member. Consider (22):

(22)	a.**s-stop**	b. **other clusters**
	spr, spl, spy: spring, splash, spew	*blw
	str:string	*sly
	skr, ski,sky,skw:scream,sclerosis,skewer, square , etc.	*psm

Broselow (1983:278)

s+obstruent is not only exceptional in CA and English but also, according to some references quoted in Broselow, in Sinhalese, Turkish, Persian, and Hindi. Thus, the exceptionality of s+obstruent is pretty universal. It is claimed that all languages adopt this representation and even impose it on loanwords. Speakers of CVC languages (as those mentioned above) must be aware of this difference in the phonological representations, and respect it in their repair strategies.

In my view, the main weakness about s-obstruent account given by Broselow is that she does not explain any phonological or phonetic reasons as to what causes this structure to be exceptional. Moreover, according to her data of errors by L2 Iraqi speakers of English, the universality of particularly placing the epenthetic vowel cluster –externally is not absolute:

(23) Errors by L2 Iraqi speakers of English:

[sitrit] 'street'
[siblaʃ] 'splash'
[sikwer] 'square'

So, although Broselow reports the situation quite well she does not offer an adequate explanation. I take a more plausible solution by Gouskova (2002). Gouskova's analysis goes along the following lines. She is of the opinion that an explanation of S-obstruent resistance to epenthesis shouldn't be sought in their structure. The explanation lies in such sonority sequencing constraints as SYLLABLE CONTACT that treats s-obstruent clusters differently from obstruent-sonorant clusters ([st..] vs [fr..], for example). SYLLABLE CONTACT is defined as:

(24) Sonority must not rise across a syllable boundary.
(Davis 1998, Hooper 1976, Murray and Vennemann 1983, Vennemann 1988).

SYLLABLE CONTACT constraint determines the site of epenthesis, when no intervention occurs by other constraints, either because SYLLABLE CONTACT is high-ranked or because its effects surface in the 'Emergence of the Unmarked' schema (McCarthy and Prince 1994). She rightly explains that in many languages epenthesis is driven by *COMPLEX, while SYLLABLE CONTACT dictates the best site. The vowel is inserted into the position that yields the optimal sequence of consonants, that is, one with falling sonority. She also makes the prediction that in all of the languages with the split pattern of epenthesis, *COMPLEX must dominate DEP to cause epenthesis in clusters. The analysis presented seems to be borne out

in CA .Her predictions hold true. In CA, *Complex dominates DEP as we see from the tableau in (25)

(25)

/klatʃ/	*Complex	DEP
a- klatʃ	*!	
b-☞ka.latʃ		*

The vowel is inserted at the edge unless the CC sequence has rising sonority (*aklatʃ). It's clear that, in the tableau above, it is the constraint SYLLABLE CONTACT that drives a vowel inside the cluster (ka.latʃ). This is always the case in onset clusters that have the rising sonority and are broken up by internal epenthesis.

(26)

/klatʃ/	*COMPLEX	SYLLABLE CONTACT	DEP
a- ʔak.latʃ		*!	*
b-☞ka.latʃ			*
c- klatʃ	*!		

S-obstruent clusters have falling sonority, so epenthesis at the edge is possible and preferred: ʔis.biitʃ> si.biitʃ. An explanation is required to account for why the default site of epenthesis in loanwords is at the edge. Comparing edge to internal epenthesis proves each is satisfied at a cost. Edge epenthesis violates NoCoda and Onset, while the dispreferred internal epenthesis actually satisfies NoCoda, Onset and Syllable Contact. She claims that the constraint that prefers edge epenthesis is Contiguity:

(27) Elements adjacent in the input must be adjacent in the output.

This constraint ensures edge epenthesis is satisfied when Syllable Contact does not matter. This is borne out in CA, too. Since both Contiguity and DEP could be violated with almost the same effect, they are equally ranked:

(28)

/sbiitʃ/	CONTIGUITY	DEP
a-☞ʔis.biitʃ		*
b- si.biitʃ	*	*!

Rising sonority inputs show that Contiguity must be ranked below SyllableContact to derive the split pattern.

(29)

/klatʃ/	SYLLABLE CONTACT	CONTIGUITY
a- klatʃ	*!	
b-☞ka.latʃ		*

So, there are the two rankings necessary to derive the split epenthesis pattern as shown in (30):

(30) a.*COMPLEX >> DEP
b.SYLLABLE CONTACT >> CONTIGUITY

The final ranking that accounts for the position of the epenthetic vowel then is:

(31) *COMPLEX, SYLLABLE CONTACT >> CONTIGUITY, DEP.

Thus interaction between SYLLABLE CONTACT and CONTIGUITY is able to explain the pattern of split epenthesis in loanword phonology in CA, where falling and rising sonority clusters are treated differently. The ranking so far should go as:

(32) *COMPLEX, ONS, MAX-IO, SYLLABLE CONTACT >> DEP-IO, ALIGN- σ, CONTIGUITY.

The quality of the Epenthetic Vowel

This sub-section determines the constraints that control the quality of epenthetic vowel. A common fact about epenthetic segments is that they lack input counterparts. Their featural realization then is dependent upon output factors. This is the situation in most languages of the world; epenthetic segments are minimally marked and contextually colored. According to (Kager, 1999, Selkirk1981, Ito, 1986, Lowenstamm and Kaye 1986) the epenthetic segment has no lexical specification to be faithful to. It is totally dependent on context-free markedness constraints. This would account for why [i] is so pervasive as an epenthetic vowel cross-linguistically. It is featurally unmarked vowel. With context-marked constraints, adjacent segments affect the featural value of epenthetic segments through assimilation. Observe patterns of epenthesis in (33) and (34).

(33)

Arabic	**English**
firizar	freezer
biristul	Bristol (paper)
fulurusint	florescent
guruub	group
kalatʃ	clutch(auto)

(34)

ʔistiryu	stereo
ʔisbiitʃ	speech

ʔisbireeh	spray
ʔistɑf	staff
ʔistub	stop
bankinut	banknote
ʃarkiskiin	sharkskin cloth
bustiman	postman

In (33) there is a case of vowel harmony between the epenthetic vowel and the immediately following one. (34) presents yet a different type of epenthesis where the epenthetic segment is invariably [i] regardless of the features of the immediately following vowel. How can we account for this variation? In the two following subsections we account for the harmony and non-harmony cases.

Harmony cases: According to Krämer (2002) featural identity of vowels which are moraically or syllabically adjacent in an output string can be accounted for by using the constraint SURFACE-IDENTITY (F) for which the general schema goes as:

(35) Let α be a vowel in *syllable/mora* 2 and β be any correspondent of α in *Syllable /mora* 1.
If β is [γF] then α is [γF], where β is an epenthetic vowel.
('An epenthetic vowel has to have the same value for a feature F as the vowel in the adjacent syllable or mora.')

According to this constraint, the feature specifications of σ 2 license the same features borne by the vowel in σ 1. The feature specification here is done by a correspondence relation. This constraint is particularly useful for this case in CA. However since the relevant features for harmony, as evidenced by group A and B, occur in terms of +/-back, +/-round features, we need to state that the harmony between epenthetic vowel and the adjacent vowel should be set in terms of the features +/-back, +/-round. We would rather modify the constraint here as follows:

(36) S-IDENT (+/-back, +/-round):
Let α be a vowel in *syllable* 2 and β be any correspondent of α in *syllable*
If β is [+/-back, +/-round] then α is [+/-back, +/-round], where β is an epenthetic vowel.

This will take care of the harmony we see between the epenthetic vowel and the adjacent one as evident from (37).

(37)

klatʃ	S-IDENT (+/-back, +/-round):	ONS	*COMPLEX	MAX-IO	DEP-IO	ALIGN- σ σ 1 σ2 σ3
☞a-ka. latʃ					*	-, μ μ
b-ku.latʃ	*!				*	-, μ μ
c-ki.latʃ	*!				*	-, μ μ
d-klatʃ			*!			

The non-harmony in terms of roundness makes (b) a suboptimal, mismatching backness harmony renders (c) suboptimal as well. (d) is outranked due to a violation of *COMPLEX .However, this constraint alone cannot predict the right candidate in some cases. Let's take the case of the word gurrub:

(38)

gruub	S-IDENT (+/-back, +/-round):	ONS	*COMPLEX	MAX-IO	DEP-IO	ALIGN- σ σ 1 σ2 σ3
a-gu.ruub					*	-, μ μ μ
b-go.ruub					*	-, μ μ μ
c-gi.ruub	*!				*	-, μ μ μ
d-ga.ruub	*!				*	-, μ μ μ

It is clear here that there is a tie situation between candidate (a) and candidate (b). This is because both candidates equally satisfy or violate the relevant constraints. Constraint S-IDENT (+/-back, +/-round) is not decisive in selecting the optimal candidate. Both [guruub] and [goruub] satisfy backness and roundness harmony. What then can decide whether (a) or (b) is the optimal form? We need some other featural constraints. Since backness and roundness are not enough to decide the exact epenthetic vowel, the features [+high][-high] will decide. The constraint *[+high] *[-high]. *[+high] can be defined as:

(39) Epenthetic vowels must not be +high.

*[-high] on the other hand is defined as:

(40) Epenthetic vowels must not be –high.

The right candidate will win based on which one of this pair of constraints is ranked above the other. In the case of [guruub], *[-high] will have to dominate *[+high].

(41)

/gruub/	S-IDENT (+/-back, +/-round):	ONS	*COMPLEX	MAX-IO	*[-HGH]	*[+HGH]	DEP-IO	ALIGN- σ σ 1 σ2 σ3
☞a-gu.ruub						*	*	-,μ μ μ
b- go.ruub					*!		*	-,μ μ μ
c- gi.ruub	*!						*	-,μ μ μ
d- ga.ruub	*!						*	-,μ μ μ

The reason why I place these two constraints below the first equally ranked package of constraints is that in each case of harmonic epenthetic vowels, one of the two constraints will have to be violated.

Non-harmony cases: When the cluster s+obstruent is there, harmony is blocked and the epenthetic vowel is set as default [i] in all cases, no matter what type of vowel follows in the adjacent syllable. This is evidenced by the words:

(42) ʔistiryu , ʔisbiitʃ , ʔisbireeh, ʔistaf , ʔistuk, ʔistub

The first three words give an indication that we are still under harmony, yet the words ʔistaf, ʔistuk, ʔistub show that there is no harmony. Moreover [i] is epenthesized as a default vowel in compounds such as [bankinut], [ʃarkiskiin], [bustiman]. Since harmony is blocked here, the constraint S-IDENT must be dominated by some other constraint that makes [i] the default epenthetic vowel in all cases where s+ obstruent cluster intervenes or when an epenthetic intervenes between two roots. This constraint must have a blocking effect so as to prevent vowel harmony. I would make use of *MULTIPLE (V.Place) constraint used by Uffmann (2001):

(43) V-to-V assimilation (harmony) is penalized.

This constraint has the effect of stopping V1 from being harmonic with V2 and as a result, with the absence of any identity between V1 and V2, the default [i][vi]shows up. So this constraint does the dual job of blocking harmony and

allowing [i] to emerge[vii]. This constraint must rank higher than S-ident, since S-ident should be violated to satisfy it.

(44)

staf	*MULTIPLE (V.Place)	S-IDENT (+/-back, +/-round)
☞a- ʔis.taf		*
b-ʔas.taf	*!	
c-ʔus.taf	*!	
d-ʔos.taf	*!	

(c) and (d) are suboptimal forms because, though in each V1 is out of harmony with V2 ,the default[i] fails to show up .[i] must always be there where harmony is not fulfilled.
The final ranking then goes as follows:

(45) *COMPLEX, ONS, MAX-IO, SYLLABLE CONTACT, *MULTIPLE (V.Place) >> S-IDENT

(+/-back, +/-round)*[+high], [-high], DEP-IO, ALIGN- σ, CONTIGUITY.

4 Conclusion

The phonological adaptation of loanwords in CA is well accounted for under OT. It is seen to emanate from constraints on syllable structure of CA. OT could achieve one very important goal, the functional unity of analysis. The trigger for all constraints is to militate against faithfulness to the input and normally to achieve well-formedness (markedness) of the forms in accordance with the syllable structure of CA. *COMPLEX, ONS, SYLLABLE CONTACT, *MULTIPLE (V.Place) represent the force of markedness that militates against identity, alignment and contiguity constraints, which stand for the opposing force of faithfulness. MAX-IO is optimal (and undominated), and thus makes sure that CA opts for epenthesis rather than deletion as a strategy for loanword adaptation; so both MAX-IO and the other markedness constraints determine the nature of vowel epenthesis in words CA loaned from English. Loanword adaptation, then, can be set within the framework of this tug of war between faithfulness and well-formedness constraints. The need to repair loanwords so as to conform to the syllable structure in CA outweighs the need to preserve the integrity of loanwords. Thus, ranking of the constraints and the way they interact are conducive to a single unified target. Namely, to have output forms that conform to

the phonotactics of CA syllable structure. This is why OT is an output-, target-oriented theory. These facts about epenthesis in loanword adaptation are only captured by a theory that is capable of showing how constraints conspire to adapt the loanword into the phonotactics of the borrowing language, CA. This substantiates functional unity. OT proves advantageous in setting all rules of loanword adaptation in CA in a constraint-based perspective within the framework of this struggle of forces in between faithfulness and markedness.

In all cases, loanwords are modified according to the productive phonological processes and constraints at work in the phonology of CA, as pointed out in section 2. Patterns of systematic modification arise according to the constraints of the native system .The analysis illustrates that loanword phonology does not require additional constraints, requiring only L1 constraints; no need arises for L2 specific constraints since, as we see, loanwords can be explained by L1 constraints. This provides a piece of evidence in favor of the view that loanwords do not require a language to have a secondary phonological system alongside the primary one.

The fact that CA opts for epenthesis rather than deletion as a strategy for adapting loanwords provides a piece of evidence to the cross-linguistically attested fact that epenthesis is a much more frequent repair strategy in loanwords than deletion. This is a reflection of the speakers' desire to maximally preserve the original input and shows that compared to deletion; epenthesis reflects less distortion of the adapted words.

NOTES

[1] Definitions of the constraints in this section are given in section 3.

[2] Though glottal stop plays a role in ascertaining that onset should exist, the main focus of the paper will be vowel epenthesis. Therefore analysis of glottal stop is not discussed in this paper.

[3] [ɑ] has the a front allophone [æ], which occurs with front consonants as in [bælæd] 'country'. For details see, Gary and Gamal (1982).

[4] It was pointed out in 2. that a maximum of two consonants may occur in word or phrase final position, e.g. [foxr] 'pride', [ʔatl] 'killing'. The constraint *COMPLEX $_{coda}$ militating against the occurrence of complex codas is not at play.

[5] Data in (18) and (19) from Gouskova (2002).

[6] According to Williams (1998), if a nucleus is unlicensed (in our case the epenthetic vowel can not be licensed to be harmonic with the following vowel), it is typically pronounced as some default vowel; the actual quality of the vowel which appears varies from one language to another. Pater (2001), in his explanation of metathesis in Balantak, shows that in case of non-assimilation, the default vowel surfaces (schwa in Balantak) instead of an assimilated one. The default vowel is, also, the typical vowel that saves an otherwise ill-formed syllable as pointed out by Feng (2002). Since we see [i] in CA assumes functions similar to those mentioned above, this provides evidence

that [i] is indeed the default vowel. Details of phonological feature structure of default [i] are not dealt with in this research.

[7] Remember this constraint takes care of the non-harmony s+obstruent cases and does not affect such harmonic cases as [guruup] for instance.

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