English Loanwords in Hijazi Arabic: Anaptyxis-based Analysis

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Abstract:

This paper examines how English words with complex syllable structures are incorporated into the phonological system of Hijazi Arabic (HA). Data provided by native speakers of HA show that English loanwords with consonant clusters often undergo anaptyxis more commonly in initial than final clusters. Further, application of anaptyxis, although incumbent in some onset clusters, may not be required in others. In this article, I argue that such asymmetry in the employment of vowel epenthesis is teleological and is perceptually driven by the relative robustness of the cluster's consonant perceptual cues, which contribute significantly to the overall perceptibility of the cluster. While anaptyxis in perceptually salient clusters is less probable, its occurrence in perceptually less privileged ones does not only adhere to the canonical prosodic structure of the host language, but it enhances the auditory cues of its segments as well. This perceptual generalization is captured in an Optimality Theoretic account that builds on a set of DEP-V context-sensitive constraints.

Key words: Anaptyxis; Loanword Phonology; Incorporation; Consonant clusters.

الاقتراض اللغوي للكلمات الإنجليزية في اللهجة الحجازية

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الملخص:

تبحث هذه الدراسة في الاقتراض اللغوي للكلمات الإنجليزية في اللهجة الحجازية، وبالتحديد في كيفية اقتراض الكلمات الإنجليزية المبدوءة والمنتهية بتركيبة الأصوات الساكنة (consonant clusters) لدى اللهجة الحجازية والتي لا تسمح بمثل هذه التركيبة الصوتية. وتشير الدراسة إلى أن عدداً من الكلمات المقترضة في اللهجة الحجازية تخضع للقوانين الصوتية في اللغة من ناحية إدخال صوت المد القصير بين الصوتين الساكنين، إلا أن بعض الكلمات لا يتم اقتراضها بنفس الطريقة حيث أنها تحافظ على تركيبة الأصوات الساكنة الخاصة بها. وتهدف الدراسة إلى إيضاح هذا التباين في عملية الاقتراض اللغوي للكلمات الإنجليزية وتعزوه إلى الاختلاف القائم بين الأصوات الساكنة في القرائن الصوتية عند استيعابها، حيث أن الدلائل السمعية لدى بعض الأصوات أقوى من غيرها مما ينعكس إيجاباً على قدرة استيعابها بشكل أكثر دقة.

الكلمات المفتاحية: الاقتراض اللغوي، صوت المد، تركيبة الأصوات الساكنة، اللهجة الحجازية.

١. Introduction

In loanword phonology, non-native forms or structures are typically adapted to the phonotactic system of the native language via a number of repair strategies that often apply to promote conformity with the phonological system of the borrowing language. When English words with onset clusters are incorporated into Hijazi Arabic (HA), complex onsets are usually simplified:

(١) English words in HA

HA		English	
/bə.rek/	<	/brek/	'brake'
/bə.rɪnt/	<	/prɪnt/	'print'

The English words /brek/ 'brake' and /prɪnt/ 'print' in (١) are consistently manifested in HA as /bə.rek/ and /bə.rɪnt/ with a vowel in-between the first two consonants. Split vowel epenthesis, also dubbed as anaptyxis or the insertion of a vowel between two adjacent consonants, occurs in (١) to accommodate a phonotactic restriction on onset clusters in HA (for similar treatment of clusters in Egyptian Arabic, see Broselow, ١٩٩٣).

Compared to deletion or, to a lesser degree, metathesis, anaptyxis is one of the widely attested processes in loanword adaptation (Silverman, ١٩٩٢), and its pervasiveness is arguably traced back to a general preservation principle in loanwords (Paradis, ١٩٩٦). Alternatively, Brasington (١٩٨١) believes that the choice between vowel epenthesis and deletion is universally positionally determined: epenthesis word initially and deletion word finally, since the initial position is typical for strengthening whereas the final position undergoes weakness processes.

Different linguistic approaches to the phonological adaptation of loanwords have been advanced in the field (Kenstowicz, ٢٠٠٣;

Paradis and LaCharité, ١٩٩٧; Peperkamp and Dupoux, ٢٠٠٣; Silverman, ١٩٩٢, among others). While a purely phonological approach deems loanword adaptation as an end-result of the host language application of a series of laws and constraints to the borrowed form (Paradis and LaCharité, ١٩٩٧; Rose, ١٩٩٥a, among others), a perceptual approach invokes concepts such as the auditory salience of segments in the borrowed form and its relative similarity to the source language. Such similarity considerations determine what features to preserve and, in case of a repair, which changes render loanwords most similar to the source. In other words, under a perceptual approach the process of loanword adaptation is believed to operate independently of the rules and constraints of the borrowing language (Kenstowicz, ٢٠٠٣; Peperkamp and Dupoux, ٢٠٠٣; Steriade, ٢٠٠١). Yet a third approach, expounded on in this paper, regards loanword adaption as subject to both phonological and perceptual factors (Silverman, ١٩٩٢; Yip, ١٩٩٣).

The focus of this paper is to argue that anaptyxis in HA loanwords consonant clusters is a phonetically motivated process rather than a purely phonological one. Anaptyxis in loanword adaptation is presumably caused by the imperceptibility of certain segments in the cluster due to their impoverished aural saliency. The paper discusses how phonetic factors contribute to vowel epenthesis asymmetries in HA adaptation of English words.

٢. Anaptyxis in Hijazi Arabic loanwords

HA is one of the most widely known dialects in the Arabian Peninsula, and is mainly spoken in the Hijaz region of western Saudi Arabia by a sedentary population (Ingham, ١٩٩٤). The sound inventory of HA consists of ٢٥ consonant phonemes, and ٩ vowels. As to syllable structure, HA exhibits both open syllables (CV) and (CVV) as well as closed syllables, (CVC) and (CVVC). While final clusters (CVCC) are tolerated in the language, initial clusters (CCVC) are illicit; thus, when English words with complex onsets are borrowed into HA, the consonant cluster (*CC-) is often

resolved by means of vowel epenthesis. The data for this exploratory study were provided by two male native speakers of HA with basic knowledge of English. According to self-report, they have always lived in the Hijaz region alongside their families and their ages ranged from ٢٥-٢٧ years old. A list of possible English loanwords in Arabic with onset and coda clusters was presented to the subjects, and their HA productions of these words were recorded. The elicited forms were examined and analyzed to reveal any anaptyxis asymmetries.

٢,١. Initial clusters

The first set of examples reveal that HA systematically reduces English loanwords with onset clusters:

(٢) /bə.rek/ < /brek/ 'brake' /bə.lak/< /blæk/ 'black'

/kə.rem/ < /krim/ 'cream' /kə.las/ < /klæs/ 'class'

/gə.rub/ < /grup/ 'group' /gə.las/ < /glæs/ 'glass'

In (٢) the English words contain a stop followed by a liquid onset /br-/, /bl-/, /kr-/, /kl-/, /gr-/ and /gl-/ and are borrowed into HA with anaptyxis.

Further examination of the data provided by the subjects in this study, however, revealed that not all English loanwords with initial consonant clusters obligatorily undergo anaptyxis when borrowed into HA. Consider the following examples:

(٣) /frem/~/fə.rem/ < /frem/ ‘frame’

/flaʃ/~/fəlaʃ/ < /flæʃ/ ‘flash’

The data in (٣) show that anaptyxis applies optionally in [fricative+liquid] onset clusters, namely /fr-/ and /fl-/. That is, native speakers of HA when uttering these loanwords sometimes introduce a vowel within the cluster, but at other times, they retain the cluster as it is in the English source language. More interestingly, anaptyctic forms are not sanctioned in the following HA list of loanwords:

(٤) /sber/ ~*/sə.ber/ < /sper/ ‘spare’

/skub/~*/sə.kub/ < /skup/ ‘scoop’

/stek/~*/sə.tek/ < /stek/ ‘steak’ /slaɪd/~*/sə.laɪd/ < /slaɪd/ ‘slide’

/snak/ ~*/sə.nak/ < /snæk/ ‘snack’

/snap/~*/sə.nap/< /snæp/ ‘Snap’

The HA native speakers in this study confirmed that it sounds completely unnatural to introduce a vowel in any of the words in (٤). Note that all the loanwords in this set contain a strident /s/ as the first element of the onset cluster, [strident +stop] in /sk-/, /sp-/, /st-/; [strident+liquid] in /sl-/; and [strident+nasal] in /sn-/.

It is important to note that Hijaz’s treatment of the loanwords in (٤) is quite exceptional as it retains the consonant cluster forms with no anaptyxis. The permissibility of such clusters raises concerns since the canonical syllable structure in HA, like that of Standard Arabic, restricts onset clusters. In fact, sequences akin to those in (٤) are prevalent in HA words but with a vowel interposing:

(٥) /sɪ.baq/~ */sbaq/ ‘race’ /sʊ.kut/~ */skut/ ‘silence’

/sɪ.ta.rah/~*/sta.rah/ ‘curtain’ /sa.lam/~*/slam/ ‘peace’

/sa.nad/~*/snad/ ‘receipt’

The examples in (٥) show that HA maintains a restriction on complex onsets as sequences of [strident+consonant] are systematically realized as CVC- in the HA lexicon. Nonetheless, in the incorporation of English loanwords it seems that HA treats [strident+consonant] clusters differently from other types of onset clusters.

٢,٢. Final clusters

Data from the informants revealed that anaptyxis asymmetries occur in the adaption of loanwords with coda clusters as well. Unlike onset clusters, coda clusters are allowed in HA and therefore English words with complex codas are expected to be unaltered when borrowed into the language:

(٦) /dɪsk/ < /dɪsk/ ‘disk’ /tost/ < /tost/ ‘toast’

/ʃert/ < /ʃɜrt/ ‘shirt’ /ʃɪft/ < /ʃɪft/ ‘shift’

/lɪŋk/ < /lɪŋk/ ‘link’

All of the coda clusters in (٦) exist in HA and are predictably produced by HA speakers with no epenthetic vowel. However, compared with (٦), the following loanwords in (٧) are sometimes produced with anaptyxis:

(٧) /faks/~/ fakəs/ < /faks/ ‘fax’

/taks/~/takəs/ < /tæks/ ‘tax’

/bʌgz/~/bʌgəz/< /bʌgz/ ‘bugs’

/ʔedz/ ~/ʔedəz/ < /eɪdz/ ‘Aids’

The words in (٧) have coda clusters that can be pronounced with and without an anaptyctic vowel even though such cluster sequences are phonotactically permissible in HA non-loanwords.

To sum up, there appears to be a clear asymmetry in the application of anaptyxis in English loanwords when adapted to HA. In onset clusters, anaptyxis is mandatory in [stop+liquid] clusters (i.e. /br-/, /bl-/, /kr-/, /kl-/, /gr-/, and /gl-/), but optional in [fricative+liquid] clusters (i.e. /fr-/ and /fl-/). In coda clusters, anaptyxis optionally occurs in [stop+strident] coda clusters (i.e. /-ks/, /-gz/, and /-dz/). The anaptyxis asymmetry in the HA data can be summarized as follows (epenthetic vowel underlined):

(٨) Anaptyxis~ø Asymmetry in Onset Clusters

a. [obstruent+liquid] → C<u>V</u>CV-

b. [strident+stop] → CCV-

c. [fricative+liquid] → C(<u>V</u>)CV-

(٩) Anaptyxis~ø Asymmetry in Coda Clusters

a. [fricative/liquid/nasal+stop] → -VCC

b. [stop+strident] → -VC(<u>V</u>)C

The asymmetry of epenthesis in the data above is very clear. In (٨a) epenthesis predictably occurs as the cluster violates the

phonotactics of the borrowing language whereas the coda cluster in (٩a) incurs no violation of the prosodic structure of the language, hence no vowel epenthsis. Crucially, (٨b), (٨c) and (٩b) represent an asymmetrical pattern of vowel epenthesis: where anaptyxis is expected to occur, it does not in (٨b), and it does but not obligatorily in (٨c). And where anaptyxis is expected not to occur, it does optionally, however, in (٩b). The pattern of anaptyxis in the data gives rise to a couple of questions: why would vowel epenthesis target some clusters and not others? And in cases where epenthesis applies, what determines the site of the epenthetic vowel?

٣. Discussion

The anaptyxis asymmetry in section ٢ presents a serious challenge for any account of vowel epenthesis, which does not take into consideration variability amongst different clusters. Factors such as type of the cluster and the relative perceptual saliency among its consonants seem to play a role in determining whether or not anaptyxis is used. Across the board cluster-banning or epenthesis-banning constraints such as *COMPLEX and DEP-V, respectively (McCarthy and Prince, ١٩٩٥) predict that either all or none of the clusters would undergo epenthesis. For example, while the ranking *COMPLEX, MAX>>DEP-V would accurately predict that anaptyxis applies in (٢) and (٣), it also incorrectly predicts that it would apply in (٤):

Table ١. Anaptyxis in /brek/ 'brake' and /stek/ 'steak'

	/brek/			/stek/		
	→ /bərek/	/brek/	/rek/	→ /sətek/	/stek/	/tek/
*COMPLEX		*!			*!	
MAX			*!			*!
DEP-V	*			*		

In Table ١, the epenthetic output /bərek/ wins over the other two candidates because it only violates low ranking DEP-V. The deletion output /rek/ is eliminated due to a violation on MAX. The non-epenthetic candidate /brek/ is ruled out by *COMPLEX. While the ranking in Table ١ works in favor of the anaptyctic output /bərek/, it fails to select the desired output for the input /stek/ as it derives /sətek/ instead of /stek/. When the ranking between *COMPLEX and DEP-V is reversed to allow for the right derivation of /stek/, it erroneously selects /brek/ as the winner:

Table ٢. Lack of anaptyxis in /brek/ 'brake' and /stek/ 'steak'

	/brek/			/stek/		
	/bərek/	→ /brek/	/rek/	/sətek/	→ /stek/	/tek/
DEP-V	*!			*!		
MAX			*!			*!
*COMPLEX		*			*	

The ranking in Table ٢ is problematic as well, and fails to derive the right output for /brek/. It appears that the incorporation of context-sensitive faithfulness constraints that target certain clusters but not others, such as CONTIG[SC], is necessary.

A phonological approach to loanword adaption views the native or host language as a filter through which loanwords are

incorporated. Thus, adaptations to the phonological form, like anaptyxis, are considered a transformation that merely brings prosodically incompatible structures into conformity with the canonical syllable structure of the borrowing language. Paradis (١٩٩٦, p. ٤) proposes a Theory of Constraints and Repair Strategies (TCRS) governed by principles such as the Preservation Principle, and the Minimality Principle:

Preservation Principle

segmental information is maximally preserved.

Minimality Principle

repairs should be minimal (as few as possible) applying to

the lowest phonological level.

According to the TCRS, vowel epenthesis is motivated by the Faithfulness constraint (Fill) in loanwords and is considered "a universal, non-contextual phonological operation that is triggered by the violation of a phonological constraint to ensure conformity to the constraint". Similarly, Silverman (١٩٩٢, p. ٢٩١) proposes that vowel epenthesis is enforced by the native syllable structure constraints at the "Operative Level of the loanword phonology, in which native phonotactic and prosodic constraints trigger various phonological operations on the perceived segments." When a word enters another language, it is perceived as an acoustic signal and is featurally mapped into segment size units at the Perceptual Level. At the Operative Level, the perceived input is subject to phonological adaptive processes dictated by the phonotactic constraints of the native language. Under Silverman's analysis, vowel epenthesis occurs at the Operative Level and it is initiated by the input's incompatibility to the prosodic constraints of the borrowing language. Further, Silverman assumes that these phonological processes such as epenthesis or deletion are exclusive to loanword phonology and exist in a module separate from that of

the native language phonology.

Contrary to phonological analyses, which argue that loanword adaptation takes place in production, Peperkamp and Dupoux (٢٠٠٣, p. ٣٦٨) propose that repair strategies in loanword adaptations, such as vowel epenthesis, take place in a perceptual level during phonetic decoding. They develop a phonetic module, which "maps a continuous acoustic signal onto a discrete representation called the phonetic surface form and a phonological form, which maps the surface forms onto potential underlying forms." In their model, vowel epenthesis, as well as other adaptive repair strategies, in loanwords are not motivated by the requirements of the borrowing language phonological system but rather by what they call "phonological deafness" or the inability of the borrowing language speakers to perceive foreign phonotactic contrasts.

Another approach is the similarity-based approach advanced by Steriade (١٩٩٩, p. ٤) who emphasizes the need for "a mechanism that relates rankings between correspondence constraints to perceived differences in degree of similarity" in a standard correspondence theory (McCarthy and Prince, ١٩٩٥). She labels this knowledge of similarity as the "P(erceptibility)-map" and maintains that it is the guiding factor for speakers to opt for outputs that bear minimal modification. Under this account, the type of epenthetic vowel as well as its site are mostly predictable. For example, Fleischhacker (٢٠٠١) suggests that the site of the epenthetic vowel maximizes auditory similarity between the epenthetic output and its non-epenthetic input. In other words, vowels are epenthesized in places where they are auditorily least noticeable. Fleischhacker claims that for [obstruent+sonorant] clusters, anaptyctic forms are more similar than prothetic forms to non-epenthetic inputs. Whereas for [strident+stop] clusters, prothetic forms are more similar than anaptyctic forms to non-epenthetic inputs.

I propose that anaptyxis in loanword consonant clusters is a

phonetically motivated process rather than a purely phonological one. In other words, it is implemented in consonant clusters only when certain segment(s) in the cluster risk misperception or even imperceptibility altogether due to loss of significant perceptual cues. Thus, its occurrence serves to enhance perceptual robustness of acoustically impoverished segments in a cluster; thereby increasing segments' perceptual saliency which limits the possibility of them being confused with other similar sounds. Following Fleischhacker (٢٠٠١) and Steriade (١٩٩٩), I argue that when epenthesis occurs, the location of the epenthetic vowel is determined by the type of the cluster; however, I suggest that, besides similarity of epenthetic outputs to their non-epenthetic inputs, the inherent (im)perceptibility of the segments in the cluster plays a seminal role. In other words, the site of the epenthetic vowel is partially determined by the same process that triggers vowel epenthesis in the first place.

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٣,١. Initial clusters

For initial clusters, anaptyxis in (٢) and (٣) seems to be conditioned by the weakness/strength of the perceptual cues of C١ in the sequence C١C٢V. Since C١ constitutes a plosive in (٢) and a fricative in (٣), a closer look at the perceptual place cues of stops and fricatives in CCV sequences is worthwhile. In a C١C٢V sequence where C١ is a stop, the place cues for the stop are more reliant on the formant transitions of the vowel (Wright, ٢٠٠٤). A stop in this environment also lacks another important cue, namely the stop release burst which is lost due to overlap with the following adjacent consonant C٢ (Jun, ٢٠٠٤). Therefore, a stop in this position risks either being misperceived or not perceived at all. However, an epenthetic vowel between the stop and the following consonant C١VC٢V enhances the perceptual cues of the stop in two ways: the CV formant transitions from the epenthesized vowel provide excellent cues for the perception of the stop, and they help retrieve the stop's transitional release burst cue since it is now unmasked by the presence of the vowel. The C٢ liquid, on the other hand, has enough perceptual information: in addition to the CV formant transitions, liquids are known to have a formant structure that serves as a good internal cue (Jun, ٢٠٠٤). This explains why in (٢) above, a [stop+liquid] cluster surfaces with an epenthetic vowel before the stops /b/, /g/, and /k/. The optionality of anaptyxis in [fricative+liquid] clusters in (٣) may be attributed to the fact that preconsonantal fricatives (C١) in a sequence C١C٢V are relatively more perceptually robust than stops.

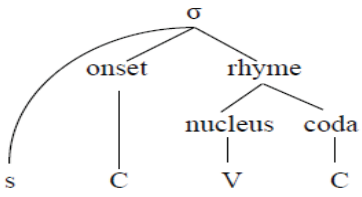
On the other hand, the perceptual cues of stridents in preconsonantal positions are far more superior than those of obstruents, stops and fricatives. Stridents in this context depend on the high frequency of aperiodic frication noise, which enables them to stand alone without the formant transitions of an adjacent vocalic element (Wright, ٢٠٠٤). This is why in [strident+consonant] clusters in (٤) anaptyxis does not apply. In such clusters, the second consonant can find ample perceptual cues in the formant transitions of the immediately following vowel (Wright, ٢٠٠٤). Additionally,

the strident itself can provide perceptual cues for the following consonant (Repp and Mann, ١٩٨٠).

It is important to note that other structurally based explanations for the odd behavior of [strident+consonant] clusters and their resistibility to anaptyxis have been entertained. For one thing, these types of clusters seem to violate the Sonority Sequencing Principle (SSP), which requires onsets to rise in sonority toward the vowel or syllable nucleolus, and codas to fall thereafter. Nonetheless, in onset [strident+consonant] clusters the strident /s/ is more sonorous than the following stop /p/, /t/ or /k/ (Broselow and Finer, ١٩٩١; Clements, ١٩٩٠). This sonority reversal explanation, however, does not hold for [strident+liquid] and [strident+nasal] clusters, which still resist anaptyxis despite their conformity to the SSP (liquids and nasals are more sonorous than stridents).

Broselow (١٩٩٣) and Kenstowicz (١٩٩٤) attribute the special status of [strident+consonant] clusters to their prosodic structure as one-unit cluster unsusceptible to vowel insertion. Giegerich (١٩٩٢), on the other hand, treats the strident in [strident+consonant] clusters as an extrametrical element adjoined directly to the syllable node (see also Barlow, ٢٠٠١):

Figure ١. Leftmost adjoining of strident in [strident+consonant] clusters



To sum up, [strident+consonant] onsets' special status, whether it is due to its violation of the SSP, which regulates consonant-vowel sequencings in syllables, or its superfluous structural makeup, sets them apart from other clusters; and it may shed some light as to why these types of clusters are more resistant to anaptyxis in the HA adaption of English loanwords.

٣,٢. Final clusters

As for the adaption of coda clusters in HA, the asymmetry of anaptyxis between the data in (٦) and (٧) becomes clear under a similar phonetic explanation. The coda clusters in (٦) are made up of a sequence of a strident, fricative, liquid, or nasal followed by a stop while in (٧) the cluster is formed by a sequence of a stop followed by a strident. Note that the clusters in (٦) are in line with the SSP requirement of falling sonority in the coda; hence the absence of anaptyxis. On the contrary, the clusters in (٧) maintain a rising sonority, a clear violation of the SSP resolved in HA through anaptyxis. Perceptually, in a $VC^{١}C^{٢}$ string, where $C^{١}$ is a fricative or liquid and $C^{٢}$ a stop, the place cues for $C^{١}$ are evident in the formant transitions of the preceding vowel (Wright, ٢٠٠٤). In addition, a fricative also benefits from its internal stridency or frication noise. For a stop in a postconsonantal position ($C^{٢}$), the place cues seem to be diminished and are heavily reliant on the offset frequency of the preceding fricative, although this cue is absent in a [liquid+stop] sequence. However, given that the speakers of HA produce stops in such clusters in an audibly released manner (i.e. with well-heard aspiration), it is presumed that the release burst quality of the stops in such contexts provides ample place cues for their perception. This claim can find support in Winitz; Scheib and Reeds (١٩٧٢); Ohala (١٩٩٠); as well as Malecot's (١٩٥٨, p. ٣٨٠):

> voiceless /p/, /t/, /k/ and voiced /b/, /d/, /g/ releases contain sufficient cues for conveying both place and manner of articulation of American English plosives in final position. These cues are powerful enough, in most instances, to override all other place and manner cues present in the vowel-plus-closing transitions segments of those plosives...

Therefore, independent of the fact that clusters in (٦) do not violate the phonotactics of the language, epenthesis into such clusters would be unnecessary and might lead to auditory obtrusiveness.

While a stop has its release burst cue to rely on in a [nasal+stop] coda string, as in [lɪŋk] 'link', the nasal's place cues are drastically reduced due to the nasalization of the preceding vowel. In a VN١C٢ sequence, the formant transitions of the nasalized vowel are less informative with respect to the following consonant than the transitions of an oral vowel (Jun, ٢٠٠٤). Nasalized vowels are perceptually more difficult due to their lowered amplitudes by anti-formants (Johnson, ٢٠١٢). Moreover, according to Wright (٢٠٠٤), nasals generally have weak internal cues for place in preconsonantal positions and this is probably why they assimilate in place to the following stop in examples such as [lɪŋk] 'link'. The reason why epenthesis does not take place here is probably due to the fact that the coda position is not as prominent as the onset position, and so given the tendency of nasals to assimilate in place to the following consonant, the imperceptibility of the nasal is decreased through nasality spreading.

Finally, in a VC١C٢ [stop+strident] sequence as in data set (٧), anaptyxis appears to be motivated by the partial imperceptibility of the stop in C١ coda cluster. Although the stop has its vocalic formant cues in the preceding vowel, it lacks the burst release cue. This suggests that the VC transition cues are relatively less significant than the burst release in the identification of a stop, a conclusion corroborated by Winitz, Scheib and Reeds (١٩٧٢) who demonstrate experimentally that the burst release of stops is the dominant cue, especially for /t/ and /p/. They also observe that their subjects produced final stops with an audible release even though VC transitions were available. Moreover, Malecot (١٩٥٨, p. ٣٨٠) asserts that "voiceless /p/, /t/, /k/ and voiced /b/, /d/, /g/ releases... are powerful enough, in most instances, to override all other place and manner cues present in the vowel-plus-closing transitions segments of those plosives..." (also see Ohala, ١٩٩٠). In opposition to this view, Wright (٢٠٠٤) argues that formant transitions dominate place perception, and that listeners resort to F٢ transitions in cases where the release burst provides conflicting place cues. This indeterminacy, coupled with the claim that the coda is a weakening position (Brasington,

١٩٨١), may explain the optionality of anaptyxis in the HA loanword data discussed in (٧).

To sum up, based on the phonetic account of the data developed so far, the following Perceptual Hierarchy for tautosyllabic initial consonant clusters is proposed:

(١٠) Scale of perceptibility in initial clusters

More Perceptible ◁——————▷ Less Perceptible

[fricative+fricative],[strident+stop]>[fricative+liquid]>[stop+continuant]>[stop+stop]

The scale in (١٠) finds basis in the typological observations on onset clusters by Morelli (١٩٩٩) who surveys onset obstruent clusters in ٢٥ unrelated languages and concludes that typologically [strident+stop] clusters are the least marked type of cluster while [stop+stop] clusters are the most marked one. The proposed scale in (١٠) reflects the relatively weak perceptual cues of stops, compared to fricatives, in preconsonantal clusters. Crucially, it states that a [stop+continuant] cluster is less perceptually salient than a [strident+stop], [fricative+liquid] or [fricative+fricative]. [stop+stop] clusters are considered the least perceptible amongst all clusters.

For coda clusters, the following partial hierarchy of perceptual goodness is assumed:

(١١) Scale of perceptibility in final clusters

More Perceptible ◁——————▷ Less Perceptible

[nasal+stop] > [stop+continuant] > [stop+stop]

A cluster made of a nasal followed by a fully released stop is perceptually more salient than a [stop+continuant] cluster; again [stop+stop] coda cluster are perceptually the poorest.

٣،٣. Site of epenthetic vowel

It follows then from the discussion so far that the location of the epenthetic vowel is chosen to increase the perceptual robustness of certain perceptually impoverished segments in the cluster. In the loanword data above, where epenthesis applies in (٢), (٣) and (٧), the epenthetic vowel is predictably anaptyctic:

(١٢) Onset clusters

[obstruent+liquid] → C<u>V</u>CV-

(١٣) Coda clusters

[stop+strident] → -VC(<u>V</u>)C

One prediction made here is that anaptyxis, as opposed to prosthesis (i.e. edge vowel epenthesis), occurs much more commonly in initial [obstruent+liquid] and final [stop+strident] clusters. Another prediction is that where across the board vowel epenthesis applies due to a stipulation of some interfering native language phonological constraints, a pattern of prothesis in [obstruent+liquid] clusters and anaptyxis in other types of clusters is never to occur. Indeed this prediction is confirmed by the typological survey of consonant clusters carried out in Fleischhacker (٢٠٠١).

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٤. Formal analysis

The formal analysis proposed here is couched in the Optimality Theory framework of analysis (Kager, ١٩٩٩), and is based on the phonetic explanation and more specifically on the perceptual scales outlined in (١٠) and (١١). The basic idea is that in the absence of conflicting phonological constraints, the determining factor for the implementation of vowel epenthesis in loanwords is the relative perceptual saliency of the clusters' segments which in turn leads to the overall perceptibility of the cluster: a less perceptible cluster is more likely to induce anaptyxis whereas a more perceptible one is less likely to do so. Further, it is suggested that anaptyxis into perceptually robust clusters would be more obtrusive than anaptyxis into perceptually weak ones.

In formalizing the analysis, I assume a slightly different notion of Steriade's (١٩٩٩) revised version of the Correspondence Theory (McCarthy and Prince, ١٩٩٥), in which speakers have detailed knowledge about the perceptibility of segments and obtrusiveness (noticeability) of epenthetic elements. This repository of knowledge about the relative similarity of segments is encoded in the speakers' grammatical component, known as the perceptibility map or the P-map (Steriade, ١٩٩٩). Thus, after Fleischhacker (٢٠٠١) and building on the universal perceptual scales in (١٠) and (١١), the following universally ranked hierarchy of context-sensitive DEP-V constraints is proposed:

(١٤) Hierarchy of context-sensitive DEP-V constraints

DEP-V/fric_fric, DEP-V/strid_stop>DEPV/fric_liquid>>DEP-V/stop_cont>>DEP-V/stop_stop

The scale in (١٤) is assumed to be universal and finds its basis in the P-map. A context-specific constraint such as DEP-V/A_B penalizes vowel epenthesis only in a cluster made up of A+B segments. This is different from the faithfulness constraint DEP-V in McCarthy and Prince's (١٩٩٥) which bans all instances of vowel epenthesis irrespective of the cluster segmental identity. Crucial to the analysis of the HA loanword data is the partial ranking of DEP-

V/stop_cont below DEP-V/fric_liquid and DEP-V/strid_stop:

(١٥) DEP-V/strid_stop>>DEP-V/fric_liquid>>DEP-V/stop_cont

Since quality of the epenthetic vowel is not the focus of this paper, the vowel in the DEP-V family of constraints will be unspecified. However, it is in most cases the schwa /ə/, especially in initial clusters.[١]

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[١] This is in agreement with Steriade (١٩٩٩) which describes the schwa and the glottal stop [?] as being the optimal choices of epenthetic elements because they are short and require minimal articulatory effort; hence their auditory unobtrusiveness.

٤,١. Initial clusters

To account for anaptyxis asymmetry in initial clusters of English loanwords in HA, the following markedness constraints are assumed, in addition to the set of faithfulness constraints in (١٤) above:

(١٦) Markedness Constraints

ONSET: every vowel must be preceded by a consonant.

C//V: a consonant is adjacent to a vowel.

The constraint ONSET (Prince and Smolensky, ١٩٩٣) bans all vowel-initial syllables while C//V (Steriade, ١٩٩٩) prohibits initial and final tautosyllabic consonant clusters. Besides the markedness constraints in (١٦), the analysis also includes the following faithfulness constraints:

(١٧) Faithfulness Constraints

MAX: no deletion.

DEP-ʔ: no glottal epenthesis.

While MAX (McCarthy and Prince, ١٩٩٣) ensures segmental integrity, DEP-ʔ prohibits the insertion of a glottal stop [ʔ]. The ranking of C//V with regard to the context sensitive constraints determines various epenthesis patterns. For HA, it is crucial that C//V be ranked above DEP-V/stop_cont and below all other constraints in order to account for the data in section ٢,١:

(١٨) DEP-V/strid_stop, DEP-V/fric_liquid, MAX, ONSET, DEP-ʔ>> C//V >>DEP-V/stop_cont

The interaction among the constraints in (١٨) is illustrated in Table ٣ below:

Table ٣. Adaptation of English loanwords with onset clusters in HA

	brek					frem					stek				
	bərek	brek	əb.rek	ʔəb.rek	rek	fərem	frem	əfrem	ʔəfrem	rem	səték	ték	əstek	ʔəstek	tek
DEP-V/strid_stop						*!									
DEP-V/fric_liquid											*!				
MAX					*!					*!					*!
ONSET			*!					*!					*!		
DEP-ʔ				*!					*!					*!	
C//V		*!					*					*			
DEP-V/stop_cont	*														

In Table ٣, the source inputs are presumably the surface English words /brek/ ‘brake’, /frem/ ‘frame’ and /stek/ ‘steak’. In /brek/ ‘brake’, the anaptyctic candidate wins over the other outputs due to its violation of the lowest ranked DEP-V/stop_cont. While the non-epenthetic output /brek/ is ruled out by C//V, which bans initial and final clusters tautosyllabically, both prothetic outputs /əb.rek/ and /ʔəb.rek/ are assigned violation marks by ONSET and DEP-ʔ, respectively. The deletion output /rek/ fails due to the faithfulness MAX constraint, which retains segments. In both /frem/ ‘frame’ and /stek/ ‘steak’, the non-epenthetic forms that are identical to the input incur the least costly violation of low-ranking C//V, and, thus, emerge as the optimal candidates.

The interaction of the markedness constraint C//V with the faithfulness DEP-V context sensitive constraints plays a crucial

role in determining the choice of clusters that undergo vowel epenthesis. In the case of HA loanwords, the choice of anaptyxis in [stop+liquid] clusters is ensured by the ranking of C//V above DEP-V/stop_cont, while having C//V dominated by DEP-V/fric_liquid and DEP-V/strid_stop does not permit anaptyxis in [fricative+liquid] [strident+stop] clusters. The site of the epenthetic vowel follows, then, from the nature of the constraints themselves; it is encoded in the context-specific DEP-V constraints and is maintained by markedness ONSET and faithfulness DEP-ʔ.

٤,٢. Final clusters

For final clusters, the same ranking in (١٨) holds with the addition of two more constraints namely, R-ANCHOR and the context-sensitive DEP-V/nasal_stop:

(١٩) R-ANCHOR: a segment at the right edge of the input must have a correspondent at the right edge of the output.

(٢٠) DEP-V/nasal_stop: no vowel epenthesis between a nasal and a stop.

The faithfulness constraint R-ANCHOR (McCarthy and Prince, ١٩٩٥) regulates the site of epenthesis in coda clusters by assigning a violation to any output with an epenthetic vowel to the right of a coda cluster. DEP-V/nasal_stop, on the other hand, disallows anaptyxis in [nasal+stop] clusters. Furthermore, critical to the analysis of coda clusters in the HA data is the need for C//V to be dominated by both R-ANCHOR and DEP-V/nasal_stop:

(٢١) DEP-V/strid_stop, DEP-V/fric_liquid, MAX, ONSET,

DEP-ʔ, R-Anchor, DEP-V/nasal_stop>> C//V >>DEP-V/stop_cont

Table ٤ below shows how the ranking in (٢١) accounts for anaptyxis in HA loanwords with coda clusters:

Table ٤. Adaptation of English loanwords with coda clusters in HA

	dɪsk				faks				lɪŋk			
	dɪsk	dɪsk	dɪs	dɪskə	fakɪs	faks	fas	faksi	lɪŋək	lɪŋk	lɪŋ	lɪŋkə
DEP-V/fric_liquid												
DEP-V/strid_stop	*!											
MAX			*!				*!				*!	
ONSET												
DEP-ʔ												
R-Anchor				*!				*!				*!
DEP-V/nasal_stop									*!			
C//V		*				*!				*		
DEP-V/stop_cont					*							

The relative position of the markedness constraint C//V is quite essential. In Table ٤, the output /dɪsk/ 'disk' is chosen over the other candidates simply because it incurs a violation of the lowest ranked C//V. For the word /faks/ 'fax', the grammar chooses the anaptyctic output /fakɪs/ as the other three contenders fail on different constraints. In /lɪŋk/ 'link', the optimal candidate is the non-anaptyctic one, /lɪŋk/ as it violates low ranking C//V. All winning candidates are evaluated in the same manner as in Table ٥. What is new here is the R-ANCHOR constraint, which eliminates outputs with an epenthetic vowel to the right of the final coda cluster. In addition, the faithfulness constraint DEP-V/nasal_stop is introduced here to block anaptyxis in [nasal+stop] codas.

٤,٣. Typological implications

The ranking of C//V in relation to the family of DEP-V context sensitive constraints gives rise to other typologically attested patterns of epenthesis. Although an extensive survey of the typologically attested patterns of vowel epenthesis is beyond the scope of this paper, some examples of epenthesis patterns in different languages are cited below:[١]

(٢٢) No Anaptyxis Pattern

DEP-V/fricative_fricative

DEP-V/fricative_liquid

DEP-V/strident_stop>> ⟹ CC-

DEP-V/stop_cont>>

DEP-V/stop_stop>>

C//V

(٢٣) Anaptyxis in [stop+stop] Clusters Pattern

DEP-V/fricative_fricative

DEP-V/fricative_liquid

DEP-V/strident_stop>> ⟹ [stopVstop]

DEP-V/stop_cont>>
C//V>>

[١]It should be noted that this is not a typology of the epenthetic vowel site. For an elaborated account of the factorial
typology of epenthesis patterns, see Fleischhacker (٢٠٠٠, ٢٠٠١).

DEP-V/stop_stop

(٢٤) Anaptyxis in [stop+stop] and [stop+continuant] Clusters Pattern

DEP-V/fricative_fricative

DEP-V/fricative_liquid

DEP-V/strident_stop>>

C//V>> ⟹ [stopVstop] & [stopVcont]

DEP-V/stop_cont>>

DEP-V/stop_stop

(٢٥) Anaptyxis in [stop+stop], [stop+continant], and [strident+stop] Clusters Pattern

DEP-V/fricative_fricative

DEP-V/fricative_liquid

C//V >> ⟹ [stopVstop], [stopVcont] & [stridVstop]

DEP-V/strident_stop>>

DEP-V/stop_cont>>

DEP-V/stop_stop

While (٢٢) is a pattern found in English for example, HA, Hawaiian pidgin English, and Russian loanwords in several dialects of Central Yup'ik (Fleischhacker, ٢٠٠١) exhibit pattern (٢٤). Although a possible pattern, (٢٣) is not attested cross-linguistically. Finally, the epenthesis pattern in (٢٥) is attested in several languages such as Korean and Punjabi (Fleischhacker, ٢٠٠١).

One implication made by this perceptual analysis is that when anaptyxis in a certain language applies to perceptually more salient clusters, it must apply to less perceptible ones as well. Thus, a language, for instance, that inserts a vowel in [fricative+liquid] or [strident+stop] clusters, must also show anaptyxis in [stop+continuant] or [stop+stop] clusters. Such prediction is indeed upheld by the typological survey in Fleischhacker (٢٠٠١) which lists no known language of the following epenthesis pattern:

(٢٦) Unattested Anaptyxis Asymmetry

No Epenthesis	Epenthesis

[stop+stop]/[stop+cont] ~ [fricativeVliquid]/[fricativeVstop]

The perceptually-based analysis also suggests that when vowel epenthesis applies, the site of the epenthetic vowel is always anaptyxis unless prosthesis is enforced by some intervening phonological constraint. This claim is in agreement with Broselow (١٩٩٣) which, although for different reasons, proposes that anaptyxis is the default epenthesis pattern in the resolution of consonant clusters. Thus, the analysis here makes another prediction: more perceptible clusters cannot induce anaptyxis unless enforced by a phonotactic or phonological constraint which would then involve anaptyxis in all clusters. Therefore, a pattern of anaptyxis in [fricative+liquid] or [strident+stop] clusters and prothesis in [stop+cont] or [stop+stop] clusters, for example, is unlikely to surface in any language universally; this too is true according to Fleischhacker (٢٠٠١):

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(٢٧) Unattested Prothesis~Anaptyxis Asymmetry

Prothesis	Anaptyxis
[V-stop+stop]/[V-stop+cont]~	[fricativeVliquid] or [fricativeVstop]

The remaining possible patterns of vowel epenthesis site include anaptyxis in [stop+cont] and prothesis in [fricative+liquid]/[strident+stop] clusters, and an across the board prothesis:

	Anaptyxis		Prothesis
(٢٨)	[stopVcont]	~	[V-fricative+liquid]/[V-strid+stop]
	Prothesis		Prothesis
(٢٩)	[V-stop+cont]	~	[V-fricative+liquid]/[V-strid+stop]

Cross-linguistically pattern (٢٨) exists in Egyptian English while the all-prothesis epenthesis pattern in (٢٩) is found in Iraqi English (Broselow, ١٩٩٢, ١٩٩٣; Fleischhacker, ٢٠٠١).

٥. Conclusion

This paper has examined HA anaptyxis patterns in English loanword consonant clusters. Some previous phonological and perceptual approaches to vowel epenthesis in loanwords were discussed. It is proposed that anaptyxis in loanword consonant clusters is phonetically motivated and that clusters vary in their relative perceptual robustness, a characteristic that ultimately determines the application of vowel epenthesis. In particular, it is hypothesized that anaptyxis would occur in perceptually less robust clusters: [stop+stop] clusters are more prone to anaptyxis than [fricative+fricative] clusters. Thus, while anaptyxis in more perceptible clusters applies merely as a repair strategy to bring them into conformity with the host language's phonological system, it further serves the purpose of perceptual enhancement in less perceptible clusters.

The perceptually-based proposal accounts for the asymmetries of vowel epenthesis patterns in HA loanwords, and is well founded on the phonetic status of stops and fricatives in clusters as shown by an array of studies. A preliminary OT analysis of the HA data, which makes use of a family of phonetically grounded DEP-V context-sensitive constraints is presented. The paper concludes with typological implications of the analysis owing to the ranking of the markedness constraint C//V with other context specific DEP-V constraints.

Appendix ١. Wordlist provided by the native speaker of Hijazi Arabic

English Word	Hijazi Pronunciation	Gloss
brek	bə.rek	brake
prɪnt	bə.rɪnt	print
blæk	bə.lak	black
blʊk	bə.lʊk	block
krem	kə.rem	cream
krep	kə.reb	crepe
klæs	kə.las	class
klʌb	kə.lʌb	club
grænd	gə.rand	grand
grup	gə.rub	group
glæs	gə.las	glass
drɪl	də.rel	drill
træn.zɪt	tə.ran.zet	transit
fri.zər	fre.zɛr~fə.re.zɛr	freezer
frem	frem~fə.rem	frame
flæʃ	flaʃ~fəlaʃ	flash
skæ.nər	skɛ.nɛr~*səkɛ.nɛr	scanner
skup	skub~*sə.kub	scoop
slaɪd	slaɪd~*sə.laɪd	slide
sper	ber~*sə.ber	spare
stek	stek~*sə.tek	steak
stɑk	stok~*sə.tok	stock
star.bʌks	star.bʌks~*sə.tar.bʌks	Starbucks
snæk	snak~ *sə.nak	snack
snæp	snap~ *sə.nap	Snap
NA	sʊ.kut~*skut	silence
NA	sa.lam~*slam	peace
NA	sɪ.baq ~*sbaq	race
NA	sɪ.ta.rah~*sta.rah	curtain

English Word	Hijazi Pronunciation	Gloss
NA	sa.nad~*snad	receipt
dɪsk	dɪsk	disk
tost	tost	toast
ʃɜrt	ʃert	shirt
kard	kɛrt	card
lɪft	lɪft	lift (elevator)
ʃɪft	ʃɪft	shift
bæŋk	bɛŋk	bank
lɪŋk	lɪŋk	link
fæks	faks~fakəs	fax
bɑks	bʊks~bʊkəs	box
tæks	taks~taks	tax
bʌgz	bʌgz~bʌgəz	bugs
eɪdz	ʔedz~ʔedəz	Aids
mɛkdanldz	mak.dʊ.naldz~ mak.dʊ.naldəz	McDonalds

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