PHARYNGEALIZATION OF FRENCH LOANWORDS IN DIALECTAL MOROCCAN ARABIC:
AN ACOUSTIC ANALYSIS OF BILINGUAL SPEAKERS

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Abstract

This paper quantitatively tests the prediction that loanword adaptation occurs in bilinguals who must resolve two competing requirements: an accurate mental representation of the word from the source language and the phonological requirements of the receiving language. The prediction is that this duel requirement would result in the phonetic quality of loanwords being categorically different for bilinguals from the phonetic quality of native words in the receiving language. French loanwords into Moroccan Arabic (MA) are often borrowed with pharyngeal secondary articulation ("emphasis"), a feature which affects the quality of adjacent vowels. To test these predictions, French-MA bilingual production of native and borrowed MA words and analyzed. The results of this study indicate evidence of this duel requirement for bilinguals.

Keywords
Moroccan Arabic, loanword adaptation, pharyngealization, bilinguals

Resumen

En este trabajo se pone cuantitativamente a prueba la predicción según la cual la adaptación de préstamos se produce en hablantes bilingües que tienen que resolver dos requisitos concurrentes: una exacta representación mental de la palabra a partir de la lengua de partida y los requisitos fonológicos de la lengua receptora. La predicción es que este requisito confrontado afectaría la calidad fonética de los préstamos, que serían categóricamente diferentes en hablantes bilingües según la calidad fonética de las palabras nativas en el idioma receptor. Préstamos del francés al árabe marroquí (MA) se han adaptado con una articulación faríngea secundaria ("énfasis"), una característica que incide en la calidad de las vocales adyacentes. Para probar estas predicciones, se han analizado formas bilingües francés-MA de nativas y préstamos MA. Los resultados del estudio muestran la incidencia en hablantes bilingües de este requisito confrontado.

Palabras clave
Árabe de Marruecos, adaptación de préstamos, faringealización, bilingües

1. Introduction

The adaptation of loanwords often requires altering the phonological representation of these words to fit into the phonology of the receiving language. Recent theories of loanword adaptation have claimed that the borrowers of loanwords from the source language into the receiving language are bilinguals of both languages and that they operate on the mental representation of the source language; however, these borrowers must adapt the sounds of the loanwords to conform to the phonological requirements of the receiving language (LaCharité and Paradis, 2005). This is opposed to a competing theory of loanword adaptation, phonetic approximation, which holds that borrowers map nonnative sound patterns onto the phonetically closest sound in the receiving language (Kenstowitsz, 2001; Peperkamp and Dupoux, 2002; 2003).

LaCharité and Paradis's theory suggests two competing requirements on bilingual production of loanwords in the receiving language: an accurate mental representation of the word from the source language and the phonological requirements of the receiving language. Thus, the prediction is that bilinguals' production of loanwords would display this duel requirement. In other words, for bilinguals, the phonetic quality of loanwords would be categorically different from the phonetic quality of native words.

The linguistic situation for Moroccan Arabic-French bilinguals is ideal to test this prediction. Moroccan Arabic has many loanwords from French which are often borrowed as "emphatic" or with pharyngeal coarticulation. This study examines the acoustics of French loanwords in Moroccan Arabic by bilinguals as compared to the production of native Moroccan Arabic words with and without contrastive emphasis. The prediction is that the French loanwords will display significantly different acoustic properties than both categories of native Moroccan Arabic words. This prediction follows from the theory of loanword adaptation that bilinguals have an accurate mental representation of the loanwords in the source language and that phoneme mismatching plays a limited role in loanword adaptation.

1.1. Pharyngealization in Loanwords

Pharyngealization, as a secondary contrastive feature, is used contrastively in all dialects of Arabic (Watson, 1999). The physiology of "emphatic" (or pharyngealized) consonants consists of a primary coronal constriction and a secondary constriction between the tongue root and the pharyngeal wall. This coarticulation has obvious articulatory and acoustic effects on a following vowel. Phonologically, emphasis has been viewed as a suprasegmental feature that affects "not merely a single consonant but a sequence of segments and syllables" (Hoberman, 1989: 73). Previous research has demonstrated that there is a lowering of F2, the formant which is correlated to vowel backness, in vowels adjacent to emphatic consonants due to the articulatory requirements on the tongue.

The effect of emphasis on adjacent vowels has been previously studied. Studies of the acoustic correlate of emphasis showed lowering of F2 in adjacent vowels in Palestinian Arabic (Card, 1983). Articulatorily, this follows from the backing of the tongue root which would cause adjacent vowel articulations to be produced further back in the mouth than canonical, or "plain", vowels, adjacent to non-pharyngealized, or plain, consonants.

When loanwords enter the borrowing language, they are often altered to conform to the phonology of that language. This is known as loanword adaptation. Loanwords borrowed from European languages in Arabic dialects are often borrowed with pharyngealization coarticulation on coronal consonants despite the fact that non-pharyngealized coronal consonants are in their inventories. The question of why loanwords often are borrowed with pharyngealization has been the subject of previous research. Naim's study of emphasis in borrowed words in Lebanese Arabic suggests this could be considered a type of "naturalization" of foreign words (Naim, 1998: 102). However, this begs the question of whether speakers of dialectal Arabic do actually distinguish between pharyngealization in native words from pharyngealization in native words.

1.2. Dialectal Moroccan Arabic

All of these factors are present in colloquial Moroccan Arabic (MA). Due to the increasingly greater influence of French in MA communities there are a substantial number of loanwords. Furthermore, there are a large number of speakers who are bilingual in both MA and French. How a speaker who is fluent in both MA and French would produce loanwords with pharyngealization in the former language with knowledge of the native pronunciation in the latter language is an intriguing question. In other words, is it possible that MA-French bilinguals have a different phonological organization for loanword adaptation. Crucially, acoustic studies of loanwords can provide insight into the phonological organization of bilingual speakers.

1.3. Research Questions

The research questions proposed for this study concern whether the acoustic effect of pharyngealization on vowels found in native dialectal Arabic words is mirrored in vowels of French loanwords borrowed with pharyngealization into MA. Furthermore, what other effects can be seen, given that informants will have native speaker knowledge of both languages.

This study examines vowels in three categories of words. The first category consists of words borrowed into MA from French with pharyngealization coartculation on the initial consonant. This category is referred to as "loanwords" or "pharyngeal borrowed" for the purposes of this study. The second category is words native to MA that have pharyngealization coarticulation on the initial consonant. This category is referred to as "pharyngeal native." Finally, the category of words which are native to MA that have no pharyngeal coarticulation is referred to as "plain native."

The following hypotheses are proposed:

First, pharyngealization affects vowel articulation in MA native words by both backing (lowering F2) and lowering (raising F1) vowel qualities for the full vowels /a/, /i/, and /u/ as compared to non-pharyngealized full vowels.

Next, loanwords with pharyngealization will have significantly different vowel qualities than native words with pharyngealization for both F1 and F2 values.

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2. Methodology

2.1. Material

The data for this study were compiled from a dictionary of Moroccan Arabic (Harrell, 1966), a book on code-switching and borrowing in MA (Heath, 1989), and the knowledge from the investigator. First, all tokens were controlled for initial consonant and initial vowel. Since emphasis in MA is phonemic coronal consonants, and the number of loanwords was limited, tokens were chosen with voiceless coronal stop /t/ and voiceless coronal fricative /s/. Thus, voicing was controlled for and manner of articulation was matched, as much as possible, across tokens. Where manner of articulation did not match across a category, as was the case for /u/, more token were selected in favor of a smaller sample size.

There are only three phonemic full vowels in MA /a, i, u/. At least one token was selected for each vowel-consonant-type pair, however, wherever possible more matched token were found. Thus, there was a total of 27 tokens: 6 matched tokens for /i/ (si-plain native /ti-plain native, si-emphatic native /ti-emphatic native, si-loanword /ti-loanword), 12 matched tokens for /a/ (2 words for each category), and 9 matched tokens for /u/ (1 word in each category for /s/, and 2 words in each category for /t/). Each token was repeated three times and said in the frame /ngolǝk __ /[1], "I say to you ___". Where possible, consonants following the first vowel were controlled for place and manner of articulation across tokens.

The elicitation was done orally, where the speakers were asked for the MA translation of a word given in English. The words were elicited at random and random non-target (filler) tokens were mixed in with the target tokens. Written forms were not given since MA is a spoken dialect, not usually written, and one of the speakers does not read Arabic script.

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[1] For one of the informants, the form was /nqolǝk __ /.

2.2. Speakers, Recording and Analysis

There were two informants for this study, native speakers of Moroccan Arabic. Furthermore, both speakers were fluent in French and English. Both were male ranging in age from mid-20s to mid-30s. One informant is from the Rabat-Sale (Central) region, while the other spent his childhood in Fes (Northern) but later lived in Casablanca (Central). Where the informants' dialects differed was in specific consonants (non-pharyngealized) of a few tokens. For example, where one speaker's token for "car" was /ṭumubila/,[2] the other speaker produced /ṭunubila/. The other instance was where one speaker's token for "brick" was /ṭub/, the other speaker has a word meaning "cube (of sugar)" with the form /ṭuba/. Nevertheless, no tokens that varied significantly across dialects in the quality of the initial consonant or vowel were used.

The data were recorded digitally with a 22kHz sampling rate. They were recorded with a head-mounted microphone (Logitech) in a sound attenuated room. All measurements were done using Praat software (Boersma and Weenink, 2010). Formant measurements were taken once for each vowel in the most stable or steady state position around the midpoint. Vowels were identified first by the spectrogram, and then confirmed through hearing. The data were then imported into Excel for statistical analysis. Bark auditory scaling was used to more accurately represent perceptual distance and dispersion. All data were scaled into Bark before further statistical analysis was done. All t-tests were two-tailed paired two sample means t-tests. Vowel measurements were Lobanov normalized using the NORMalize Suite software (Thomas and Kendall, 2007). Vowel normalization was performed in order to most accurately eliminate talker-related variability (Adank et al., 2004).

3. Results

The vowel means for both speakers, with ellipses representing one standard deviation from the mean, are given for both speakers Lobanov Normalized in Table 1.

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[2] A dot under the consonant indicates pharyngeal secondary constriction. The IPA symbol for this segment is /tˤ/.
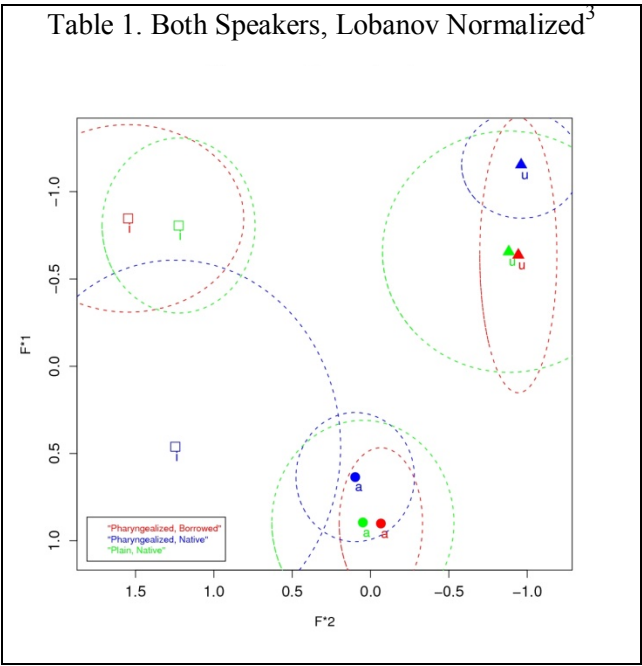
Table 1. A plot of both speakers' vowel data, shows much variation and deviation from the means
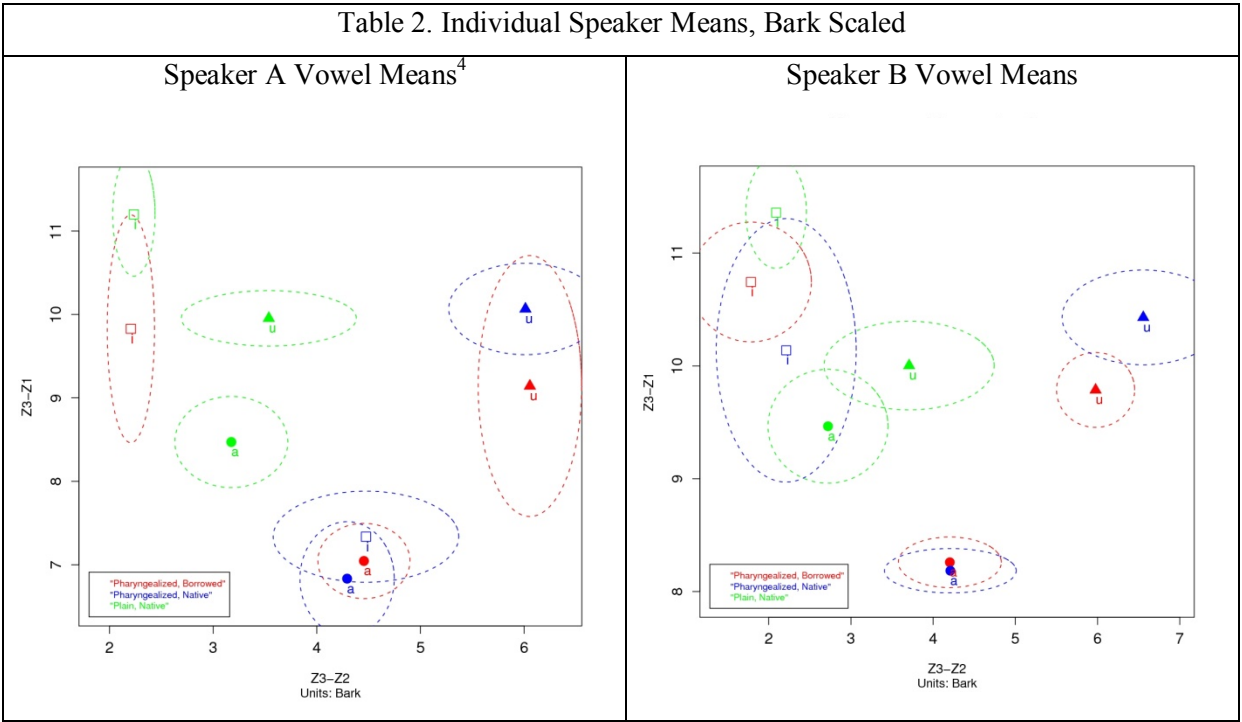

Table 2. A plot of each speakers' individual vowel data is more revealing

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The charts in Table 2 show the speaker means for each vowel and each category. Looking at Table 2, several facts become obvious.

First, for both speakers the pharyngeal native vowel space is shifted back compared to the plain native vowel space. This follows from the articulatory prediction that pharyngeal coarticulation would cause adjacent vowels to be lowered and pulled back due to the position of the tongue body. Specifically, pharyngeal native /i/ and /a/ are consistently lower and backer than plain /i/ and /a/, respectively, while pharyngeal native /u/ is consistently backer and higher than plain /u/. However, a significant pattern with both speakers is that the plain native vowel space appears smaller than the pharyngeal native vowel space. In other words, these data suggest the plain vowel space has less contrast than the pharyngeal vowel space.

The next observation from the plots in Table 2 is that there does not appear to be a difference between pharyngeal native /a/ and pharyngeal borrowed /a/. On the other hand, pharyngeal borrowed /u/ is consistently lower for both speakers than pharyngeal native /u/.

Finally, Table 2 suggests that pharyngeal native /i/ is not consistent for either speaker. For speaker B, pharyngeal native /i/ has a huge standard deviation while for speaker A, pharyngeal native /i/ falls directly in the pharyngeal native (and borrowed) /a/ space.

These observations and are investigated through statistical analysis and discussion in section 4, below.

4. Discussion

4.1. Phonemes /a/ and /u/

Concerning the hypothesis that F2 of vowels in loanwords will be significantly different than F2 of vowels in emphatic native words, this was not confirmed for phonemes /a/ and /u/. A t-test indicated that F2 of /a/ in loanwords was not significantly different from F2 of /a/ in emphatic native words (t(23)=-.48505, p=.632). Furthermore, the hypothesis that F2 of /a/ is significantly lower in loanword vowels than in plain native vowels was confirmed; a t-test indicated that F2 of /a/ in loanwords

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was significantly lower than F2 of /a/ in plain native words (t(23)=-10.1713, p<.05). Meanwhile, a t-test indicated that F2 of /u/ in loanwords was significantly lower than F2 of /u/ in plain native words (t(17)=-9.06154, p<.05). In effect, words have been borrowed from French with full pharyngeal coarticulation, not significantly different from native words with pharyngeal coarticulation with respect to vowel backness.

The data also showed that F1 of /a/ in loanwords was higher than of /a/ in plain native words (t(23)=7.4272, p<.05). In other words, there was a lower /a/ vowel in loanwords. This would follow from a pharyngeal constriction. By pulling the tongue root back, which is what was shown for /a/ in loanwords, a lowering of the tongue might also occur, lowering F1 values significantly.

However, if this was a natural distinction between vowels in plain native words and vowels in emphatic loan/native words, then why do the data show F1 in /u/ of loanwords significantly higher than F1 in /u/ of emphatic native words(t(17)=2.47059, p<.05)? To answer this question, we will first go to the source language, French. In (1) two of the loanwords are illustrated with their French form and their MA form:

(1)   <u>French</u>   <u>MA</u>

a. "car"   [otᴐmᴐbil]   [t̲umubil(a)]

b. "bus"   [otᴐbys]   [t̲ubis]

It is here that the influence from the mental representation of the French form on the MA pronunciation for the speakers is most likely. It has been shown that there is no distinction between F2 in loanwords borrowed with emphasis and F2 in native words with emphasis for these speakers, demonstrating that they are employing that feature with no interference from the origin language However, a t-test indicated that there was no significant difference between F2 in loanwords and F2 in emphatic native words, t(17)=1.29304, p=.213. Nevertheless, it appears likely that French vowel quality, specifically vowel height, has an effect on production in MA differentiating the loanword vowel quality from the native emphatic word vowel quality.

For comparison, the quality of /ᴐ/ from a study of Standard French oral vowel quality was averaged at 550 Hz for F1 for male speakers (Gendrot and Adda-Decker,

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2005). The value of /u/ in loanwords, which correspond to /ɔ/ in the French words, was 486 Hz with a standard deviation of 131.1 Hz. The F1 values in MA loanwords do appear influenced by speaker knowledge of the phonology if the origin word[5].

Most likely, the effect cannot be seen for /a/ because height does not play a major role in differing vowel qualities for /a/ in neither MA nor French

4.2. Phoneme /i/

When analyzing the data for the /i/ phoneme, the hypothesis that /i/ for F2 in loanwords will be significantly different from F2 in /i/ for emphatic native words rather than like F2 of /i/ in plain native words was confirmed (t(11)=2.7022, p<.05). On the other hand, F2 in /i/ for loanwords was not significantly different than F2 of /i/ in plain words (t(11)=-1.40286, p=.188).

What is most puzzling is where /i/ in native emphatic words patterns, in general. The second puzzling thing is that /i/ in loanwords is patterning like /i/ in plain words, which is the opposite trend found for /a/ and /u/ in the same categories. I will address each of those concerns here:

First, by looking at Table 2, it is evident that /i/ in native emphatic words tends to drift towards the space for /a/ in plain native words. Two separate t-tests indicated that the difference between formants in /i/ emphatic native versus /a/ plain native was not significant. In other words, they are essentially the same vowel.

Before making this assumption, however, one thing needs to be established. Namely, what constitutes that claim that the /i/ in native emphatic words is (or was) underlying /i/? The words used in this study as tokens for /i/ in emphatic native words are shown in (2).

(2) a. "metal tray" /ṣiniya/

    b. "clay"   /ṭin/

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[5] While this evidence is not conclusive, as the French formant values are not from the same speakers in the present study and the present study does not compare to the French study as far as number of tokens.

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The dictionary from which these words were taken (Harrell 1966) uses phonemic representations. There is no note for these words mentioning whether there is dialectal variation or free variation as to the vowel quality. Nevertheless, other sources have similarly used the same phonemic spelling of these words. Richard Harrell, in his 1962 grammar of Moroccan Arabic, has the same spelling of "metal tray" with an /i/ (1962: 85). He also has no mention of variation. In a different book by Heath on Jewish dialects of Moroccan Arabic, he has the form /ṭiniya/ alternating with /siniya/ in several dialects, but no discussion of this alternation (2002: 135). Heath's study of code-switching in MA lists /ṣin/ as "clay" and makes no mention of variation (1989: 169).

Basically, there is nothing in the previous research done on MA that suggests that these representations were not accurate at time they were recorded. On the other hand, note also that there are only two tokens. This is a problem. Furthermore, the standard deviation for /i/ in these words was 1.605 Bark for F1 and 1.478 Bark for F2. This is a large range of variability, with some values tending more towards the /i/ space but others tending more towards the /a/ space from the average.

Conservatively, we can say that more studies with a larger amount of data are needed in order to make any conclusions. Based on this study alone, we could say that there is a change occurring in the underlying representation of /i/ directly following emphatic segments, at least for one speaker. In effect, what this speaker's data indicates is that the lowering of F2 and F1 in /i/ adjacent to consonants with pharyngeal coarticulation could have led (or eventually lead) to a shift in perception that there are actually low vowels with no emphasis. Crucially, this follows from the notion of maximal perceptual distance, that phonemes in a language should be as distant from one another to be significantly perceptible (Blevins, 2004). In other words, in a vowel system with three phonemic vowels, like MA, different environments affecting the quality of a vowel and such a large amount of variability could lead hearers to interpret the sound as existing in another vowel space. Thus, a change could have occurred over time where emphatic /i/ was reanalyzed as underling /a/.

In any event, an explanation is needed for why F2 of /i/ in loanwords was not significantly different than F2 of /i/ in plain native words. However this result would make sense if there was indeed a change in the representation of /i/ in emphatic native words in MA. If /i/ emphatic has essentially be reanalyzed as /a/ plain in native words,

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then there is currently only one place to map /i/ of loanwords onto MA phonology: /i/ plain.

5. Conclusion

The objective of this study was two-fold: to compare the acoustics of vowels in French loanwords in Moroccan Arabic with that of vowels in native plain and native emphatic words and interpret those results from the perspective that bilinguals are the source of loanwords who have two competing requirements on the production of loanwords in the receiving language: an accurate mental representation of the word in the source language and the phonological requirements of the receiving language.

The results of this study were not straightforward, but overall they indicated evidence of this duel requirement for bilinguals. For /a/, pharyngeal borrowed and pharyngeal native patterned the same. This does not necessarily contradict our hypothesis. Both Moroccan Arabic and French have only one low vowel which is central: /a/. There is no indication that for the bilinguals the mental representation for /a/ in French and Moroccan Arabic would be different. Thus, the duel requirements for loanwords are fulfilled for these speakers and there need not be a difference in production of the pharyngeal native and the pharyngeal borrowed /a/.

For /u/, there is explicit evidence of these duel requirements for bilinguals using loanwords. The data indicated that pharyngeal borrowed /u/ was significantly lower than pharyngeal native /u/. By examining the quality of the vowel in the source language of the loanword, we can observe that it is /ɔ/, an acoustically lower vowel than /u/ in the French word. Thus, there is an effect from the origin language on these bilingual speakers. The bilinguals produce the loanword phoneme categorically different from native phoneme.

Furthermore, the comprehensive results for /i/ were interesting. Most significantly, the quality of the vowel for /i/ native emphatic was nowhere near the general vowel space for /i/. The emphatic native /i/ was generally patterning in the /a/ vowel space. Additional t-tests indicated that, in fact, there was no significant difference between the quality of /i/ emphatic native and /a/ plain native. This result, tangential to the original goals of this study, provokes further research questions.

Crucially, Is it the case that emphatic /i/ is lowered by pharyngealized environments so much that it is being reanalyzed as underlying plain /a/? Further, what affect does this have on the status of emphatic /i/ in MA, in general, as it seems that loanwords with /i/ are patterning with plain native /i/. On the other hand, F1 of loanword /i/ is significantly different from plain native /i/ suggesting the same effect of native speaker knowledge on the height of the vowel in the origin word. In any event, further investigation and analysis is needed in order to make conclusive claims concerning these questions.

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