THE EPENTHETIC VOWELS IN PERSIAN LOANWORDS: THE DIFFERENCE BETWEEN MONOLINGUALS AND BILINGUALS

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1. Introduction

It is widely acknowledged that loanwords go through a set of changes to match the phonological system of the target language (Broselow 1982; Itô 1989; Kuijpetrs & Donselaar 1997; Côte 2000; Olson 2003 among others). One common change is adding a vowel (aka epenthetic vowels) to the initial position of loanwords which start with a consonant cluster in languages that do not allow initial consonant clusters such as Spanish and Persian. Previous studies have concluded that the phonetic properties of epenthetic vowels in loanwords are different from lexical vowels in native words. For example, the length of the epenthetic vowel in loanwords is found to be shorter than the length of the lexical vowel in native words (Miner 1979; Davidson & Stone 2003; Widdison 2004; Gouskova & Hall 2009).

In Persian, consonant clusters are blocked word-initially as in (1a). Therefore, an epenthetic vowel /e/ is added to the initial position of the loanwords which start with sC cluster as in (1b).

(1) a. * stabl ‘stable’ b. **e**stabl ‘stable’

The first objective of the current study is to explore whether the properties of the epenthetic vowel /e/ added to the initial position of loanwords are different from its lexical counterparts in Persian. To do so, a group of loanwords starting with a /st/ cluster (e.g. *estable* ‘stable’) in Persian is selected and compared with Persian native words starting with /est/ (e.g. ***est****axr* ‘swimming pool’).

Secondly, there have been few studies which have investigated the properties of epenthetic vowels in loanwords in bilinguals. According to parallel phonological activation hypothesis (Marian & Spivey 2003; Blumenfled & Marian 2007, 2013; Darcey et al. 2015), it is expected that syllable constraints in both languages should be activated in bilinguals. Thus, when these constraints do not match, the more dominant language of the bilingual speaker is expected to win over the less dominant language. With this in mind, it is expected that bilingual speakers whose L1 and L2 are in contrast in terms of allowing consonant clusters word-initially might be under the influence of their more dominant language and produce loanwords closer to their more dominant language’s syllable constraint.

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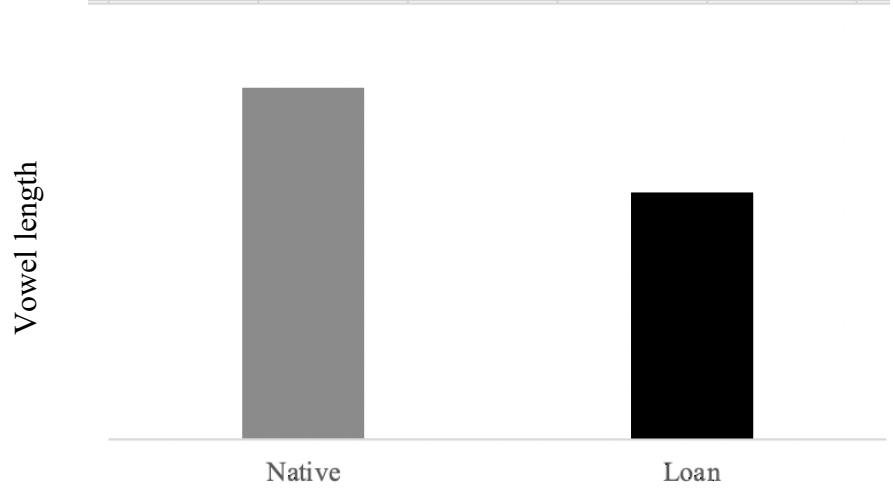
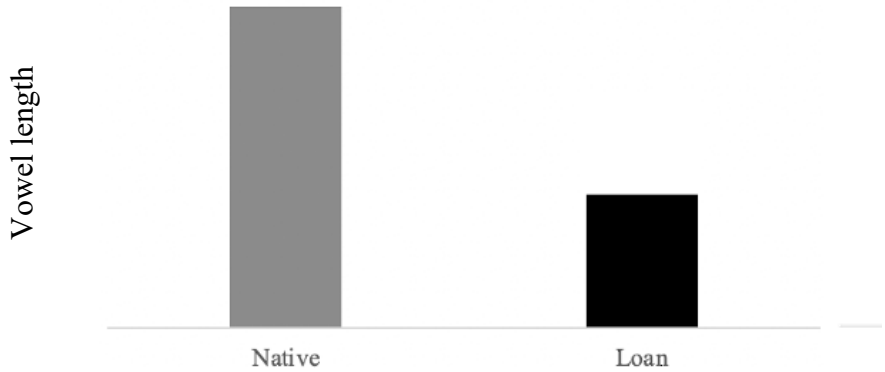
Thus, the second objective of this study is to explore whether and how English-Persian bilinguals produce loanwords differently from their monolingual counterparts. In order to do so, a group of English-Persian bilinguals are recruited to read sentences including both loanwords and native words which were discussed earlier, and their production is compared with Persian monolinguals. To determine the degree of bilinguals' dominance in each language, a Bilingual Language Profile (Gertken, Amengual & Birdsong 2014) is used.

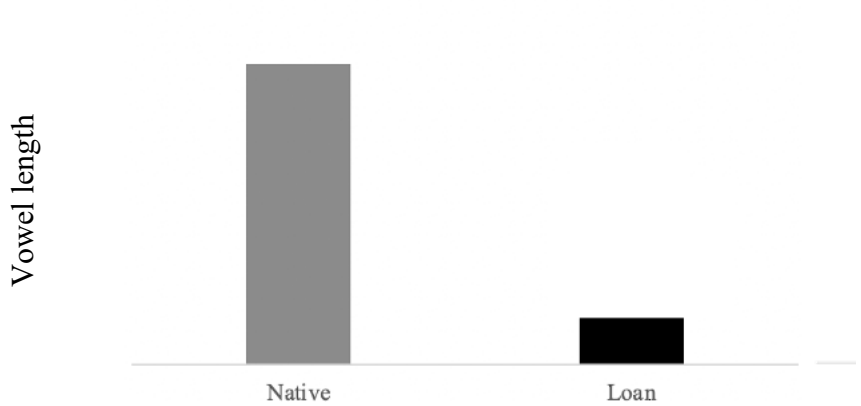
With regards to the first objective of the study, it is predicted that Persian monolinguals produce shorter epenthetic vowels in loanwords than lexical vowels in native words. Moreover, Persian-dominant bilingual speakers are expected to produce epenthetic vowels more like Persian monolinguals under the influence of their dominant language which is Persian. English-dominant bilinguals, on the other hand, are predicted to be more tolerant of sC clusters and thus are expected to produce shorter epenthetic vowel under the influence of their dominant language which is English. Figure 1 summarizes the predictions of the epenthetic vowel's length for different types of words.



(a) Persian monolinguals



(b) Persian-dominant bilinguals



(c) English-dominant bilinguals

Figure 1. Predictions of the epenthetic vowel's length based on the type of the word

2. Background

In this section, a brief overview of previous studies in the field of vowel epenthesis is provided. Section 2.1 provides the theoretical background with regard to the vowel epenthesis in general. Section 2.2 discusses vowel epenthesis in Persian loanwords. In section 2.3, the properties of epenthetic vowels and their difference with lexical vowels are explained. Finally, section 2.4 delineates how bilingual speakers might behave differently from monolinguals in producing epenthetic vowels.

2.1 Vowel epenthesis

Vowel epenthesis - the process of adding a vowel to a word (Hall 2011) – is classified into two main categories (Crystal 2008): *anaptyxis* in which an epenthetic vowel is inserted word-medially and *prothesis* in which a vowel is added to the initial position of the word. The choice between the two is language specific. There is a variety of proposals why an epenthetic vowel is added to the input among which are the resyllabification of consonant clusters (Itô 1989), the markedness of a particular format of consonant clusters in a given language (Broselow 1982), better perception of consonants (Côte 2000), bringing a word up to a certain minimal size (e.g. in Mono spoken in Congo) (Olson 2003) and matching the prosodic features (e.g. adding an epenthetic vowel to a word at the end of intonational phrases with a final-syllable stress in Dutch and Galician) (Kuijpers & Donselaar 1997)

Although many studies do not observe a difference between repairing strategies in loanwords and native words, some studies suggest there should be some differences between the two. In Japanese native words, for example, consonant clusters which are the result of morpheme concatenation are repaired through consonant deletion. In Japanese loanwords, though, consonant clusters are repaired through vowel epenthesis (McCawley 1968; Smith 2006). A similar pattern is observed in Persian where one of the consonants

in a CCC cluster is usually deleted in native words, whereas an epenthetic vowel is added in Persian loanwords (Karimi 1987).

The reason for the difference between repairing strategies in native words and loanwords is believed to be associated with the "Preservation Principle" (Paradis & LaCharite 1997 as cited in Hall 2011) according to which language users try to preserve phonological segments maximally. Based on this, adding a segment is more desirable than deleting a segment. For this reason, vowel epenthesis is preferred over other repairing strategies in loanwords as it retains all segment materials and makes perception of loanwords easier.

2.2 Vowel epenthesis in Persian loanwords

Persian blocks consonant clusters word-initially (Ghorbanpour et al. 2019). For this reason, a vowel is inserted either word-internally or in the initial position of the words beginning with sC(onsonant) clusters. The pattern for splitting clusters in Persian is believed to match with the sonority profile of the cluster (Singh 1985).

Gorbanpour et al. explain the split pattern of the vowel insertion in Persian loanwords through optimality theory and a set of constraints. According to the "Syllable Contact" constraint (aka Syll-CON) (Gouskova, 2004; McCarthy 2008), the syllable boundary must have a falling sonority profile. In other words, there is a tendency for the onset of a syllable to be less sonorous than the previous segment. As can be seen in (2), there are two options available in Persian for inserting an epenthetic vowel. After inserting the vowel, the loanwords are re-syllabified which leads to the creation of a new syllable boundary. The new syllable boundary should match the sonority profile. As can be seen in (2a), the vowel /e/ is inserted between /p/ and /l/ which creates a falling sonority profile across syllables. In (2b), though, the vowel /e/ is inserted in the initial position which leads to the creating of a rising sonority profile across the two adjacent syllables. This rules out cases like (2b) in which /l/ is more sonorous than its previous segment /p/.

(2) a. PER: p**e** . lâs . tik
'plastic'

b. PER: *ep . lâs . tik
'plastic'

In some cases, though, the vowel is inserted word-initially in the actual output, although inserting the vowel within the cluster does not violate the sonority profile of syllables as in (3). This is explained through a set of other constraints such as DEP-V (McCarthy & Prince 1995, 1999; McCarthy 2008) based on which every output vowel must have an input correspondent, CONTIG (Gouskova 2003; McCarthy 2008) where no morpheme-internal epenthesis is permitted and Syll-CON constraint (Ghorbanpour et al. 2014: 111). To get the actual output in (3), the following constraint ranking has been suggested: DEP-V, Syll-CON and CONTIG. In (3a), the vowel /e/ is inserted within the sC cluster which violates both DEP-V and CONTIG. In (3b), it is inserted word-initially and only the DEP-V constraint is violated. Thus, the optimal output would be (3b) with a vowel epenthesis in the initial position.

(3) a. * s**e**. ki → ‘skiing’ b. **e**s . ki → ‘skiing’

There are, however, some cases where the vowel is inserted in the initial position while Syll-CON constraint is violated. This is seen in /sl/, /sm/ and /sn/ clusters. As can be seen in (4b), if the vowel is inserted in the initial position, the sonority profile across the syllable boundary is violated. If it is inserted between consonants, though, it conforms to the sonority profile as in (4a). But, as can be seen, the actual output is the one in which Syll-CON is violated. To explain this, Ghorbanpour et al. introduce two additional constraints: DEP-V/s_N and DEP-V/s_L. According to these constraints, no vowel can be inserted between a sibilant and a nasal or a liquid in Persian. It should be mentioned that these constraints must be ranked higher than Syll-CON constraint to rule out cases such as (4a). Table 1 summarizes how vowels are inserted in Persian loanwords.

(4) a. * s**e**.mok → ‘smoke’ b. **e**s.mok → ‘smoke’

Table 1. The pattern of vowel insertion in Persian loanwords with initial consonant clusters

	[sC]	**elsewhere**
apantyxis *(inserting the vowel between consonants)*		teran ‘train’ felash ‘flash’ peranses ‘princess’
prothesis *(inserting the vowel in the initial position)*	**e**smok ‘smoke’ **e**sterâteji ‘strategy’ **e**sfanj ‘sponge’	

2.3 The properties of epenthetic vowels

There is a growing body of evidence suggesting that the properties of epenthetic vowels are different from those of lexical vowels in a given language. Miner (1979) explores whether the properties of the epenthetic vowel in Hocank – a Siouan language – are different from the lexical vowel. The findings of these studies confirm that the epenthetic vowel is not only shorter than the lexical one, but also it affects the duration of the following vowel.

In Spanish, Navaro (1963) concludes that the length of the epenthetic vowel added to consonant clusters including a liquid is shorter than the lexical vowel. In contrast, Bosch and de Jong (1997) concludes that epenthetic vowels in Scots Gaelic is longer than lexical vowels when the CC cluster is preceded by a short stressed vowel as in /tarav/ where the underlined epenthetic vowel is longer than the lexical vowel in the same position because it comes after a short stressed vowel.

In English, Davidson and Stone (2003) examines the properties of the schwa inserted in pseudo-Slavic words which begin with an illegal consonant cluster in English such as /zgmomu/. They find that the inserted schwa in these pseudo words is significantly shorter than the lexical schwa in native English words such as '*succumb*' /səccʌm/.

In a perceptual study, Widdison (2004) explores the perception of manipulated epenthetic vowels in CC constructions in Spanish. The results show that participants associate shorter vowels (around 17ms) to the CC cluster. This is significantly shorter than lexical vowels in Spanish (around 70ms). In another study, Ramirez (2006) concludes that the epenthetic vowel inserted in consonant clusters is significantly shorter than lexical vowels in Spanish (27ms vs. 86ms).

Similarly, Gouskova & Hall (2009) concludes that the duration of the epenthetic vowel /i/ in Lebanese Arabic is shorter than its lexical counterpart (76ms vs. 85ms). Moreover, the results of their study show that the epenthetic vowel /i/ has a lower F2.

On the flip side, a second group of studies find no difference in properties of epenthetic vowels and lexical ones. Guirao & Garcia (1991), for example, concludes that there is no difference between formants of epenthetic vowels and lexical vowels in Spanish. Similarly, Blecua (2001) observes no difference between the length of epenthetic and lexical vowels in Spanish.

In summary, previous studies have suggested that the length of epenthetic vowels in loanwords is different from the length of lexical vowels in that language. Putting aside some counter evidence, many of these studies have reported a shorter length for epenthetic vowels in loanwords compared to lexical vowels.

2.4 Bilingualism in loanword adaptation

It is acknowledged that in bilinguals both languages are activated at the same time despite one of them being dominantly active (aka Parallel Activation) (Green 1998; Dijkstra & van Heuven 2002; Blumenfled & Marian 2007; Kroll et al. 2008; Shook & Marian 2013; Freeman et al. 2016). Parallel phonological activation has also been reported in previous studies (e.g. Marian & Spivey 2003; Blumenfled & Marian 2007, 2013; Darcey et al. 2015). However, the extension of parallel activation of phonological systems to phonotactic constraints as well as the effect of language dominance on this activation in bilinguals are understudied. In the following paragraphs, a brief summary of studies in this field is explained.

Broselow (1984) explores whether the syllable structure is transferred from a dominant language to the other in Arabic-English bilinguals. The results show that Arabic dominant bilinguals resyllabify English words in accordance with the syllable constraints in Arabic. She then proposes a hypothesis known as *Syllable Structure Transfer Hypothesis* based on which language speakers tend to retain the syllable structure of their L1 while producing L2 words.

As more evidence, Oliveira et al. (2010) explores the perception of epenthetic vowels in consonant clusters by Brazilian-Japanese bilinguals and compare the results with the findings of Japanese and Brazilian monolinguals. In both Japanese and Brazilian Portuguese, consonant clusters are blocked, but are treated differently. Whereas Japanese

speakers tend to add /u/ within the cluster, Brazilian speakers prefer adding /i/. In an explicit vowel identification task, participants are asked to identify the epenthetic vowel inserted in a set of non-word consonant clusters such as *'abna'*, *'agda'*, etc. They expect Japanese monolinguals to hear more /u/ sound as an epenthetic vowel and Brazilian monolinguals to hear more /i/ sound as an epenthetic vowel consistent with their first language tendency. This hypothesis is confirmed in that Japanese and Brazilian monolinguals select /u/ and /i/ more than other vowels respectively, which is in line with their native language preference. First generation speakers (i.e., Japanese speakers who immigrated to Brazil and started to learn Brazilian in adulthood) behave like their Japanese counterparts selecting more /u/. Second generation bilinguals (i.e., children who were exposed to Japanese at home from early childhood but dominantly exposed to Brazilian at school) as well as simultaneous bilinguals (i.e., children who had exposure to both languages equally from infancy) behave more like Brazilian monolinguals selecting /i/. The result of this study demonstrates that bilinguals might be under the influence of their dominant language which is observed in their perception.

Mohamed et al. (2019), in a similar study, investigates whether phonotactic constraints are transferred from L1 to L2. The stimuli of their study include a set of Spanish word pairs occurring in a sentence. The first word in the pair ends in a vowel and the second word in the pair begins with a vowel (e.g. *hacha amarilla* 'yellow ax'). As onsetless syllables are not permitted in Arabic, Arabic speakers tend to add a glottal stop to the beginning of words beginning with a vowel (i.e. [?am]). Spanish speakers, though, use a number of strategies to avoid onsetless syllables such as hiatus, diphtongization, vowel elision, vowel elision with lengthening as well as glottal stop epenthesis when the preceding word ends in a vowel. Thus, they propose that Arabic-Spanish bilinguals might add more epenthetic glottal stops under the influence of Arabic compared to Spanish monolinguals who might make use of different repairing strategies. In addition, they suggest that bilingual type (i.e. simultaneous vs. early sequential) and language dominance in bilinguals might play a role as well. The results of their study reveal that there is no significant difference in glottalization between bilinguals and monolinguals. However, language dominance is a predictive factor such that Arabic-dominant bilinguals add more glottal stops to the onset position as a repairing strategy. No difference is observed between early sequential and simultaneous bilinguals, though, suggesting that as bilinguals are exposed to Spanish in school years, language dominance is shifted.

More specific to the purpose of this study, Byers and Yavas (2016) explores the difference between the length of schwa sound in schwa-deletable and non-deletable contexts in English monolinguals and Spanish-English bilinguals. Their materials include a set of schwa-deletable words (e.g. *probably*) and non-deletable words (e.g. *imaginative*) in a carrier sentence. The results of their study show that the length of the schwa in deletable contexts is significantly shorter than in non-deletable contexts in both monolingual and bilingual groups. However, there is no difference in the schwa length in deletable contexts between monolinguals and early bilinguals. Late bilinguals produce longer schwas than their monolingual and early bilingual counterparts.

In summary, despite some discrepancies, previous studies have suggested shorter length for epenthetic vowels in loanwords. In bilinguals, the phonotactic constraint of their

dominant language might affect the production of epenthetic vowels such that they produce epenthetic vowels more like native speakers of their dominant language. The following section explains the design and methodology of the study testing whether these patterns extend to Persian.

3. Design and methodology

3.1 Overall design

The categorical independent variables in this study are Word Type (*Loan* vs. *Native*) and Speaker Group (*Monolingual* vs. *Bilingual*), while Dominance is a continuous variable only for the bilingual group. The only dependent variable is the length of the epenthetic or native vowel /e/. Table 2 illustrates the variables of the study.

Table 2. Overall design of the study

		Word Type	
		Loan	*Native*
Speaker Group	*Monolingual*	Condition 1	Condition 3
	Bilingual	Condition 2	Condition 4

3.2 Participants

Twenty Persian monolingual and 19 English-Persian bilinguals are recruited to participate in the study. The monolingual group includes 11 males and 9 females living in Iran with an average age of 27.35 (ranging between 22 and 37). None of the monolingual participants have experience of living abroad or being in contact with English at their workplace. All have basic knowledge of English learnt at school or university. The monolingual participants are paid 500000 IRR (~$3) as an incentive. The bilingual group includes 8 male and 11 female English-Persian bilinguals with an average age of 18.75 (ranging between 18 and 21) who were born or raised in Canada from childhood. All have at least a highschool diploma. To determine the degree of their fluency in each language, they are asked to fill in a self-reported survey prior to the test. This survey, the Bilingual Language Profile, is discussed in detail in Section 3.3. The bilingual speakers are paid $10 as an incentive.

3.3 Instruments

Data of the study is collected through two main instruments. The first instrument consists of a set of Persian sentences produced by a Persian synthesizer in a robot voice. The second instrument is used only for the bilingual group to determine their dominance in each language. Each instrument is explained in detail in the following sections separately.

3.3.1 Persian stimuli

The main test includes 30 experimental trials and 88 filler sentences. Each sentence begins with a Persian male proper noun ending in the voiceless stop /k/, *Babak*, in the subject position which is constant through all items. This is followed by either a Persian loanword, a Persian native word or an unrelated word in the object position. The verb is either the affirmative or negative form of verbs 'like' or 'know'. Sample trials are given in (5).

(5) Babak **estâdiyom/estaxr/pitzâ** -râ dust na-dâr-ad
Babak stadium/pool/pizza-DOM like NEG-have-3SG
'Babak doesn't like the stadium/swimming pool/pizza.'

All experimental trials and filler items are mixed with each other in a pseudo-randomized way such that no two experimental trials come one after another and the list starts with two filler items. All items are recorded using a Persian synthesizer in a robot voice developed by ASR Gooyesh Pardaz (2019)[1].

3.3.2 Bilingual language profile (BLP)

The second instrument is an online self-reported survey known as Bilingual Language Profile (henceforth BLP) developed by Gertken, Amengual & Birdsong (2014) to determine the degree of language dominance in bilinguals. The full format of the test is available at http://sites.la.utexas.edu/bilingual/.

The whole survey consists of 19 multiple-choice questions preceded by a demographic section. The questions are classified in four different modules each weighed equally. The Language History module collects information such as the acquisition age of each language, the age at which the bilingual speaker has started to use both languages comfortably, the number of years the bilingual speaker has used each language at school, the length of time the bilingual speaker has spent in a country where each language is widely spoken and the extent to which the speaker uses each language at home or at the workplace. The Language Use module explores how much bilingual speakers use each language in an average week with their friends, family, school and work, how often they talk to themselves in each language and how often they use each language when counting. The Language Proficiency module taps into how well they speak, listen, read and write in each language. The Language Attitude module explores the degree to which they like themselves when speaking each language, the degree to which they identify themselves with the culture of each language, the degree to which speaking native-like in each language is important to them, and the degree to which being identified as a native speaker of each language is important to them. Figure 2 taken from Gertken et al. (2014: 220)

[1] The reason for using a synthesizer with a robot voice is to make the task seem more authentic. As asking participants to repeat a human voice for the purpose of recording their voice seems less motivating, participants are told that a robot is learning Persian and their voice helps it to learn better and produce more native-like sentences.

shows the format of BLP for English-Spanish bilinguals. In this study, however, the questions are modified to match English-Persian bilinguals. The whole test scores range between -218 to +218. A score near zero indicates balanced bilingualism and more positive or more negative scores reflect respective language dominance. A negative score indicates that bilingual speakers are more Persian-dominant and positive score means they are more English dominant.

3.4 Procedure

Participants of both groups are scheduled a timeslot to attend Skype meetings. Bilingual speakers, in addition, are asked to fill in the online BLP survey discussed earlier prior to the meeting. Both groups are given instructions how to do the test both verbally and in the written form which is shared on the screen. The written instructions are in English for the bilingual group as most of them are not able to read in Persian.

There are three practice trials prior to the main test where they get familiar with the procedure and ask questions if they have any. Participants listen to each trial once and repeat what they hear aloud as clearly as possible. After running through half of the test, they are given a short break. The entire test takes about an hour. The whole Skype meeting is recorded for further analysis.

3.5 Data analysis

All audio files are first transcribed in Praat (Boersma & Weenink 2018). Those items in which participants are not able to produce the target word (i.e. Loanword or Persian native word) and those items with background noise are excluded. This leads to a total removal of two items. The data is then statistically analyzed in R (R Core Team 2020) using a linear mixed-effect modelling method with ItemType and SpeakerGroup as fixed effect factors and Participant and ItemNumber as random effect factors. To see whether the dominance in each language is correlated with the difference between the length of the epenthetic vowel in loan words and length of the native vowel in Persian native words, a correlational analysis is done over bilingual subset of data.

4. Results

In order to find the best-fitting model for the data, the most complex model is first formed where all fixed and random effect factors are included as in (6).

(6) Model = Length~ItemType*SpeakerGroup + (1|Participant) + (1|ItemNumber)

To see whether random effects are statistically significant in the model, each random effect is removed one at a time and the resulting model is compared with the previous one. The results reveal that Participant is a significant random effect, whereas the ItemNumber is not. This means that participants are behaving differently from each other. The best-fitting model is reformulated in (7) and Table 3 summarizes the statistical analysis.

(7) Model = Length~ItemType*Group + (1|Participant)

Table 3. Summary of results

	Estimate	Std. Error	df	t-value	Pr(>|t|)
(Intercept)	0.091573	0.004208	40.373191	21.759	**<2e-16 *****
ItemTypeLoan	- 0.001911	0.002212	907.2	3.387	0.3877
GroupBilingual	0.004800	0.005865	40.16378	-0.818	0.4180
ItemTypeLoan: GroupBilingual	0.006248	0.003057	987.16558	2.044	**0.0413 ***

As can be seen, the results show that there is a significant interaction between the speaker group and item type such that native words are produced with a longer vowel by monolinguals. Figure 2 shows the difference between the vowel length in native and loanwords for both groups[2].

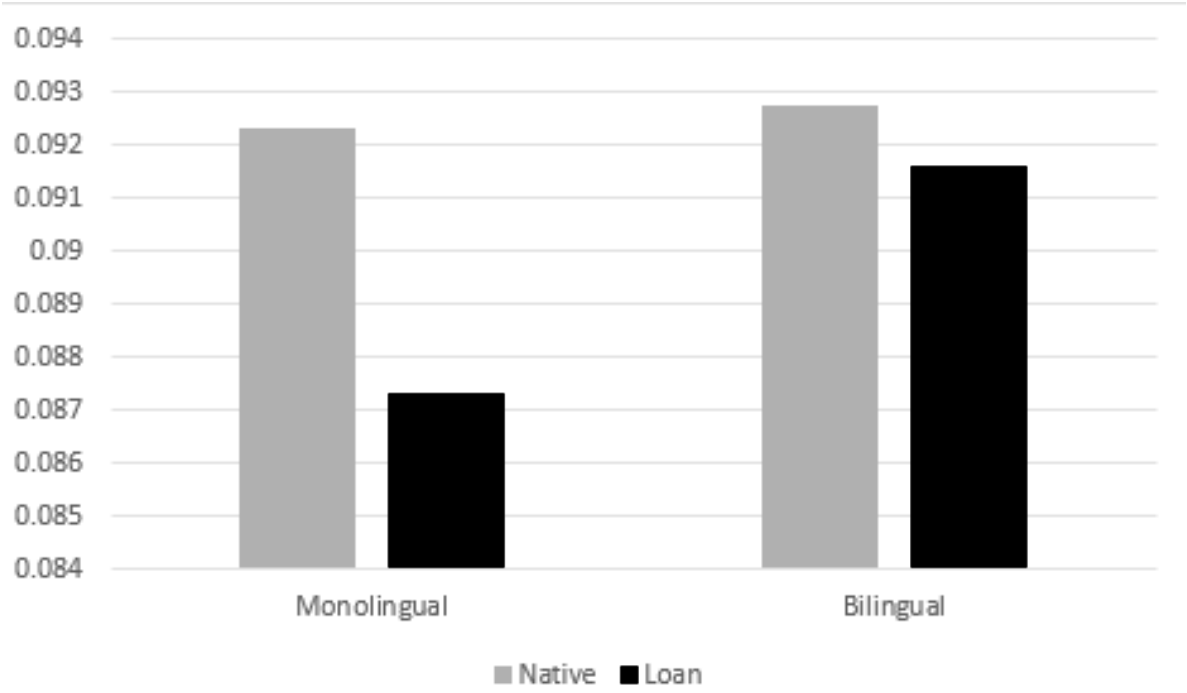


Figure 2. The average vowel length (in seconds) for different words types

[2] It should be mentioned that the data for one bilingual speaker is not included in the analysis as the mean length of her epenthetic vowel in loan words is extremely low (23ms) which is two standard deviations lower than the mean of the epenthetic vowel (92ms). This is in contrast to the length of her native vowel (102ms) which is close to the mean length of the native vowel by bilinguals (93ms) and within one standard deviation from the mean.

As post-hoc analysis, three sets of pair-wise comparison are conducted. The first set checks the difference between native and loan words in monolinguals and the second set checks the same difference in bilinguals. The third set compares the difference in the length of the epenthetic vowel between monolinguals and bilinguals. After adjusting the p-value using Holm-Bonferroni correction method (Holm 1979), the difference in the vowel length between loan and native words is found to be significant only for monolingual speakers (p=.029*). For bilingual speakers, though, the difference is not found to be significant (p=.532), although the mean of the epenthetic vowel's length in loanwords is lower than the mean of the native vowel's length in native words. As for the difference between monolinguals and bilinguals, the third set of pair-wise comparison shows no significant difference between the vowel length (p=.435), but the mean of the epenthetic vowel for bilinguals is higher than the mean length of the epenthetic vowel for monolinguals.

To see whether the dominance in each language has an effect on the difference between the vowel length of loan words and native words in bilingual speakers, the Pearson correlation coefficient is calculated. The result finds no significant correlation between the two ($r = -0.235$, $p=.348$) which means that there is no relationship between participants' dominance in either language (i.e. Persian or English) and the difference between the vowel length of loan words and native words[3].

Figure 3 shows the mean duration of epenthetic and native vowels for each bilingual participant. As can be seen, English-dominant bilinguals (i.e. those with positive dominance scores) have more variability in the mean length of both epenthetic and native vowels (standard deviation of 21.89) compared to Persian-dominant bilinguals (standard deviation of 13.63).

In summary, the findings reveal that (i) epenthetic vowels are produced significantly shorter than native vowels only by Persian monolinguals, (ii) English-Persian bilinguals do not produce epenthetic and native vowels differently, and (iii) there is no relationship between dominance in the language and producing epenthetic and native vowels differently. The following section discusses the results and compares them with previous studies.

[3] To see whether the number of syllables has affected the vowel length, a separate analysis finds no significant correlation between the number of syllables and length of the vowel.

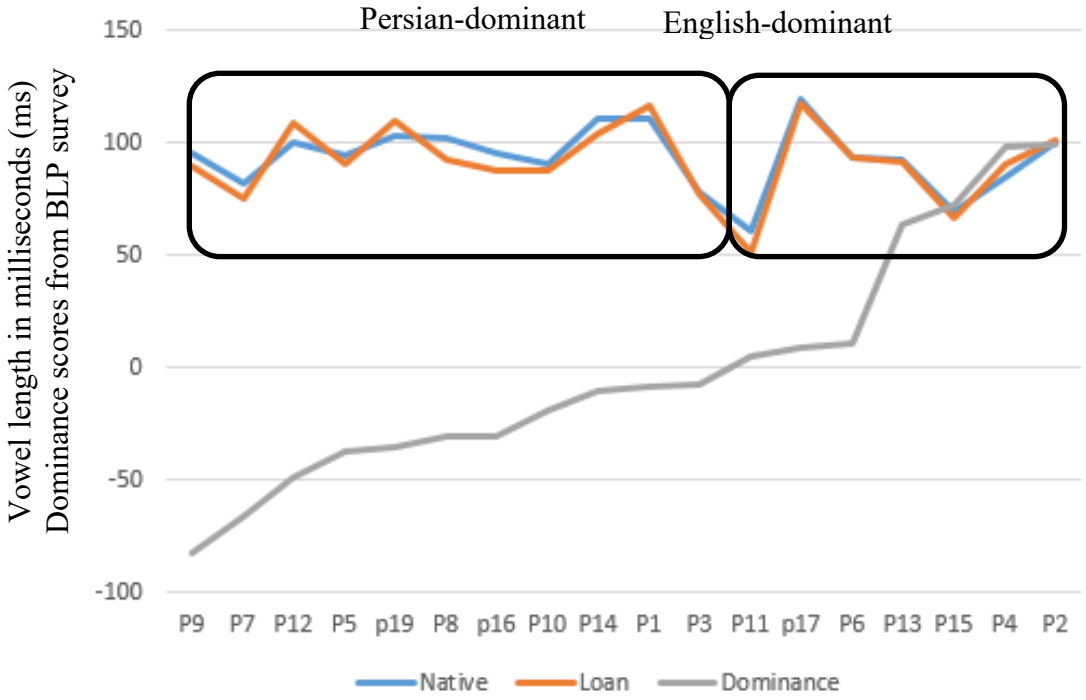


Figure 3. The mean length of epenthetic and native vowels for bilingual speakers

5. Discussion

The results of this study reveal that Persian monolinguals produce epenthetic vowels in loanwords significantly shorter than native vowels. English-Persian bilinguals, however, do not produce epenthetic vowels in loanwords and lexical vowels in native words differently.

As for Persian monolinguals, our hypothesis is confirmed in that the epenthetic vowel is produced shorter in length compared to the native vowel. This is in fact in line with previous studies which suggest that epenthetic vowels should be phonetically different from their lexical counterparts (Susman 1943 & Miner 1979 in Hocank; Davidson & Stone 2003 in English; Widdison 2004 & Ramirez 2006 in Spanish; Gouskova & Hall 2009 in Lebanese Arabic). The results, however, are contradictory from Guira & Garcia (1991) and Beluca (2001) in Spanish where no significant difference is found between the length of epenthetic vowels and lexical vowels in Spanish. The results also contradict Bosch & de Jong (1997) in which the epenthetic vowels are longer when the cluster is preceded by a short stressed vowel in Scots Gaelic.

As for bilinguals, the results do not match the original predictions in two ways. First, bilinguals do not produce epenthetic vowels shorter than their monolingual counterparts. Instead, they produce epenthetic vowels close to lexical vowels in terms of length which suggests that they might be unable to distinguish between loanwords and native words. As a result, they consider all stimuli as native words. This is supported by comparing their

mean vowel length (920ms) with the mean vowel length of native words in monolingual group (923ms).

There are two possible reasons for this. First, the vocabulary knowledge of bilinguals is not tested prior to this study. For this reason, although the researcher has tried to use words which are commonly used in daily Persian conversations it is not clear whether they know all Persian words used in trials. Therefore, when they are instructed to repeat a set of Persian sentences, they might possibly think that all words in the trials should be native words in Persian including the loanwords and, thusly, they do not produce a shorter vowel length in loanwords. However, taking a precise look at trials reveals that loanwords which are used in trials are very similar to their English pronunciation as can be seen in Table (4). Thus, producing longer epenthetic vowel in loanwords due to a lack of vocabulary knowledge might not be a very satisfying explanation.

Table 4. List of loanwords in main trials

Persian	English	Persian	English	Persian	English
/establ/	stable	*/estârt/*	start	*/estori/*	story
/estâdiyom/	stadium	*/esteyk/*	steak	*/esterâteji/*	strategy
/estamp/	stamp	*/estil/*	steel	*/esteres/*	stress
/estand/	stand	*/estok/*	stock	*/esterech/*	stretch
/estândârd/	standards	*/estop/*	stop	*/estodiyo/*	studio

Another reason for why bilinguals produce epenthetic vowels in loanwords similar to lexical vowels in native words might be due to their overcorrection. In other words, bilinguals might be aware of the fact that consonant clusters cannot occur word-initially in Persian and overcorrect themselves. As a result, they add an epenthetic vowel which is not different from a lexical vowel in terms of length.

From another perspective, the analysis of Persian-dominant and English-dominant bilinguals reveal no correlation between the length of epenthetic vowels and language dominance of speakers; in both groups, epenthetic vowels and lexical vowels are produced similarly. However, the individual variation is higher in the English-dominant group. This suggests that English-dominant speakers might be less certain about how long the epenthetic vowel in loanwords should be unlike their Persian-dominant counterparts. That said, no statistically significant difference is observed between the two groups. This can support the overcorrection hypothesis as well. English-dominant bilinguals are just familiar with the sC-cluster's constraint in Persian and add a vowel in the initial position of loanwords. Persian-dominant group, on the other hand, not only adds an epenthetic vowel to the initial position of loanwords but also consciously overcorrect and produce a longer epenthetic vowel (closer to native Persian words) compared to their monolingual counterparts.

6. Conclusion

This study is aimed at exploring whether Persian speakers produce epenthetic vowels in loanwords shorter than lexical vowels in native words and whether English-Persian bilinguals produce epenthetic vowels shorter under the influence of English. The results show that Persian monolinguals produce epenthetic vowels significantly shorter than lexical vowels which confirms the original hypothesis. However, the results of the bilingual group are not conclusive in that they produce epenthetic and lexical vowels similarly long.

While the difference in the monolingual group is statistically significant, the small difference between the vowel length (i.e., 50ms) casts doubt on whether results are meaningful. For this reason, a perception study is suggested to see whether speakers can perceive the difference.

In short, while results of the first section of the study are consistent with findings in other languages which suggest that epenthetic vowels in loanwords should be shorter than lexical vowels in native words, more research is suggested on the effect of bilingualism on the properties of epenthetic vowels in Persian loanwords.

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