On the Epenthetic Vowels in Mandarin Accented English

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Abstract
This paper discusses the epenthetic vowels in Mandarin accented English. Four different epenthetic vowels occur in different contexts according to the preceding consonants. An Optimality Theory approach is employed to provide an analysis. NoObstruentCoda and *CC trigger vowel epenthesis. While the default epenthetic vowel is schwa, the interaction of Agree[feature] constraints and Mandarin phonotactics can also shape the epenthetic vowels. A full understanding of the epenthetic vowels may require further discussion of the perception grammar of Mandarin speakers.

Keywords: Mandarin accented English, epenthetic vowels, Optimality Theory, interlanguage

1. Introduction
In the acquisition of a second language, not only do learners access their native language (henceforth, NL) grammar, but there is grammar functioning at the intermediate level. Such grammar is termed interlanguage (henceforth, IL) grammar. It is not merely a transfer of the NL grammar. It also demonstrates features of the target language (henceforth, TL) grammar. The IL grammar can vary from individual to individual until the learners fully acquire the TL grammar (Broselow 2004). In this study we are going to examine certain cases of Mandarin accented English, and an Optimality Theory (Prince and Smolensky 1993/2004) approach will be employed to account for the pronunciation in the leaners’ interlanguage.

2. Literature Review
Vowel epenthesis has been a widely observed phenomenon as a repair strategy used to adapt foreign language syllable structures. In languages that do not allow consonant clusters, certain vowels are inserted. The following data are adopted from Broselow’s (2011) study on the quality and position of inserted vowels. For Japanese speakers, a default vowel [u] is inserted in the case of クリスマス ‘Christmas’. The inserted vowel can sometimes be contextually determined. For Shona speakers, a vowel sharing features with the neighboring
consonant is inserted in the case of burandi ‘brandy’ (b and u share the feature [labial]). Radwanska-Williams and Yam (2001) studied the acquisition of English plosives by Chinese speakers and found that they use either vowel epenthesis or coda deletion as the repair strategy, and the epenthesis is more preferable. The inserted vowel after a plosive coda is a schwa. Therefore, Chinese speakers would produce [fɪˈtə] when the target is “fit”. While the main focus of Radwanska-Williams and Yam’s study is on the percentage of different strategies used by Chinese and Cantonese EFL (English as a foreign language) learners, this current study concentrates on the epenthesis of different vowels in different contexts. The epenthetic vowel is either context free (as the Japanese default ɯ) or context dependent (as the Shona u). Four types of syllable structures are allowed in Mandarin phonotactics: CV, CGV, CVN, CVr (er suffixation). When encountering foreign syllable structures other than the four types, Mandarin speakers employ vowel epenthesis as one of the repair strategies. For example, when Mandarin speakers are dealing with an English CVC structure, a vowel is inserted after the coda consonant and the CVC is resyllabified as CV.CV as shown in (1).

(1)  bed [bɛd] → [pe.tə]
fish [fɪʃ] → [fi.ʃy]

The underlined segments are the epenthetic vowels. Besides, certain sound changes occur according to Mandarin phonotactics and they are beyond discussion in this paper. As for English CCV structure, a vowel is inserted after the first consonant of the consonant cluster and the structure is resyllabified as CV.CV as shown in (2).

(2)  blue [blu] → [pu.lu]

English allows consonant clusters in both onset and coda position, and the cluster is not limited to two consonants. The CVC and CCV structure is the usual case where vowel epenthesis occurs. A triconsonantal cluster can trigger deletion or other repair strategies, and accordingly adds up to the complexity for analysis. Therefore, the following data are collected mainly in Mandarin speakers’ production of English CVC and CCV structures.

3. Different types of epenthetic vowels

Most Taiwanese people are bilingual (speak Mandarin and Taiwanese Southern Min or Hakka). Some are even trilingual (speak all three languages above). Besides, there are a small number of Mandarin and Austronesian speakers. This may result in the complexity of the NL
grammar. Technically we cannot find purely Mandarin accented English here in Taiwan. The multiple influences of different languages can lead to variations. The case discussed in this paper is only one of the variations.

3.1. The [ə] epenthesis

The examples in (3) show the [ə] epenthesis.

(3)  

<table>
<thead>
<tr>
<th>English</th>
<th>Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>top [tʰap]</td>
<td>[tʰa.pʰə]</td>
</tr>
<tr>
<td>pub [pʰʌb]</td>
<td>[pʰa.pə]</td>
</tr>
<tr>
<td>cat [kʰət]</td>
<td>[kʰe.tʰə]</td>
</tr>
<tr>
<td>bed [bʰəd]</td>
<td>[pe.tə]</td>
</tr>
<tr>
<td>like [laɪk]</td>
<td>[laɪ.kʰə]</td>
</tr>
<tr>
<td>dog [dʰɔɡ]</td>
<td>[to.kə]</td>
</tr>
</tbody>
</table>

The oral stop codas [p, b, t, d, k, g] in English map to [pʰ, p, tʰ, t, kʰ, k] respectively in Mandarin because there is no voicing but aspiration distinction in oral stops in Mandarin phonetic inventory. [ə] is inserted after an oral stop.

3.2. The syllabic [z] epenthesis

The examples in (4) show the syllabic [z] epenthesis.

(4)  

<table>
<thead>
<tr>
<th>English</th>
<th>Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>bath [bæθ]</td>
<td>[pe.sz]</td>
</tr>
<tr>
<td>cheese [tʃiz]</td>
<td>[tʃʰi.sz]</td>
</tr>
<tr>
<td>kiss [kʰɪs]</td>
<td>[kʰi.sz]</td>
</tr>
</tbody>
</table>

The English interdental and alveolar fricatives all map to dental fricative [s] in Mandarin. Syllabic [z] is inserted after a dental fricative.

3.3. The [y] epenthesis

The examples in (5) show the [y] epenthesis.

(5)  

<table>
<thead>
<tr>
<th>English</th>
<th>Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>fish [fɪʃ]</td>
<td>[fi.ʃy]</td>
</tr>
<tr>
<td>garage [ɡə.ɹæɡ]</td>
<td>[kə.ɹa.dəɡy]</td>
</tr>
<tr>
<td>match [mətʃ]</td>
<td>[me.tʃy]</td>
</tr>
<tr>
<td>page [pʰeɪdʒ]</td>
<td>[pʰeɪ.dʒy]</td>
</tr>
</tbody>
</table>
The English alveo-palatals remain similar in Mandarin because there are segments in similar place of articulation in Mandarin phonetic inventory. [y] (a high front rounded vowel) is inserted after a alveo-palatals.

3.4. The [u] epenthesis

The examples in (6) show the [u] epenthesis.

(6)  beef [bif] → [pi.fu]
      leave [liv] → [li.fu]

The English labiodentals [f, v] both map to [f] in Mandarin due to a lack of voicing contrast in its phonetic inventory. [u] is inserted after a labiodental.

4. The Optimality Theory Account for Vowel Epenthesis

The Optimality Theory (OT) is a constraint-based theory derived from generative phonology. There are universal constraint sets in human language, and language diversity is attributed to different rankings of constraints. On this view, Mandarin speakers employ different repair strategies from speakers of other languages in that the constraint ranking in their interlanguage grammar is different from speakers of other languages.

4.1. The [ə] epenthesis

Lombardi (2002) proposed a set of context-free markedness constraints in the determination of the epenthetic vowel using cross-linguistic evidence. She claimed the least marked vowel is inserted, and languages may vary in the constraint ranking when it comes to the least marked vowel. The variation lies in the contrast between the height, the backness, and the rounding of the vowel. I argue the least marked epenthetic vowel in the IL grammar of Mandarin accented English is [ə] as in (7).
The five candidates in the tableau are the five vowels in Mandarin vowel system. By ranking *low above *nonlow, [a] is knocked out. By ranking *front above *back, [i] and [y] are knocked out. By ranking *+round above *-round, [u] is knocked out. [ə] wins out and is the default epenthetic vowel in the IL grammar of Mandarin accented English. Interestingly, Mandarin phonotactics prevents /ə/ from surfacing in an open syllable unless it is tensed as [ɤ]. However, [ə] is allowed in the open syllable in the IL grammar of Mandarin accented English as can be attested in the case of bed [bɛd] → [petə].

To account for the epenthesis, I posit two constraints.

8. **NoObstruentCoda**
   - Assign one violation mark for every coda consonant.

9. **Dep-V**
   - Assign one violation mark for every epenthetic vowel.

By ranking NoObsCoda higher than Dep-V, epenthesis is triggered.

The faithful mapping of the CVC structure is knocked out by NoObsCoda, and candidate a. with an epenthetic vowel wins out. Because [ə] is the least marked epenthetic vowel, it is used as the default epenthetic vowel in Mandarin accented English.
4.2. The syllabic [z] epenthesis

Duanmu (2007) proposed that [z] and [ʐ] are two syllabic consonants in Mandarin; [z] occurs after the dentals [ts, tsʰ, s] whereas [ʐ] occurs after the retroflexes [tʂ, tʂʰ, ş]. To account for the syllabic [z] epenthesis, I posit one more constraint.

(11) Agree[+fricative]

Assign one violation mark for every epenthetic vowel that does not agree in the feature [+fricative] with the preceding consonant.

By ranking Agree[+fricative] higher than Dep-V, syllabic [z] is preferred to the default schwa.

<table>
<thead>
<tr>
<th>/kʰis/</th>
<th>NoObsCoda</th>
<th>Agree[+fricative]</th>
<th>Dep-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → kʰisz</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. kʰis</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. kʰisə</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
</tbody>
</table>

4.3. The [y] epenthesis

Because the alveo-palatals bear the feature [+high, -back], I posit the following constraint to account for the [y] epenthesis.

(13) Agree[+high, -back]

Assign one violation mark for every epenthetic vowel that does not agree in the feature [+high, -back] with the preceding consonant.

By ranking Agree[+high, -back] higher than Dep-V, [y] is preferred to the default schwa.

<table>
<thead>
<tr>
<th>/fɪʃ/</th>
<th>NoObsCoda</th>
<th>Agree[+high, -back]</th>
<th>Dep-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → fɪʃy</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. → fɪʃi</td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>c. fɪʃ</td>
<td>*!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. fɪʃə</td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
</tbody>
</table>
Although there are two optimal outputs in the tableau, the actual optimal output is \([f\,i\,ʃ\,y]\). According to Ladefoged (1993), English alveo-palatal fricatives are strongly labialized. Even though such quality does not require the following vowel to be also labialized in English, it can be a requirement in Mandarin phonotactics. The articulation of English alveo-palatal \([ʃ, ʒ, \,tʃ, dʒ]\) requires the rounding of the lips whereas the articulation of Mandarin alveo-palatal \([tc, \,tc^h, c]\) requires the spreading of the lips. However, when a Mandarin alveo-palatal precedes a rounded vowel, it is phonetically rounded in the anticipation of the rounded vowel, and thus becomes phonetically similar to an English alveo-palatal. Therefore, to fully account for the \([y]\) epenthesis, another constraint must come into play.

(15) **Agree[labial]**

Assign one violation mark for every epenthetic vowel that does not agree in the feature [labial] with the preceding consonant.

This constraint requires the agreement of the feature [labial] between the alveo-palatal and the following epenthetic vowel, which is phonetically motivated by Mandarin phonotactics. The revised tableau is shown in (16).

(16)

<table>
<thead>
<tr>
<th>/f,i,ʃ/</th>
<th>NoObsCoda</th>
<th>Agree[+hi, -bk]</th>
<th>Agree[lab]</th>
<th>Dep-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. → f,i,ʃ,y</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>b. f,i,ʃ,i</td>
<td></td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
<tr>
<td>c. f,i,ʃ</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>d. f,i,ʃ,ə</td>
<td></td>
<td></td>
<td>*!</td>
<td>*</td>
</tr>
</tbody>
</table>

4.4. The \([u]\) epenthesis

The \([u]\) epenthesis always occurs after the labial consonants. Therefore I posit the same constraint stated in (15), and the tableau is shown in (17).
There are two optimal outputs in this tableau although the actual optimal output is [pifu]. The choice of [u] over [y] is attributed to Mandarin phonotactics which prevents [f] from preceding a front rounded vowel. Therefore I posit a constraint to demonstrate such restriction.

(18) *fy
Assign one violation mark for every segment [f] that precedes a front rounded vowel.

The constraint is incorporated into the tableau as follows.

4.5. Summary
So far we have examined the CVC structure in the Mandarin accented English. A vowel is inserted after the coda, and then resyllabification occurs and changes the CVC structure into CV.CV. Such mechanism can be accounted for by OT. NoObsCoda >> Dep-V triggers vowel epenthesis. Certain Agree[feature] constraints along with a *fy constraint constitute different contexts for different epenthetic vowels other than the default schwa. An overall constraint ranking is shown below.
4.6. The epenthesis and resyllabification for consonant clusters

For English consonant clusters, epenthesis and resyllabification also occur in Mandarin accented English as shown in (21). The epenthetic vowels are underlined.

\[
\text{(21) } \begin{align*}
\text{CCV} & \rightarrow \text{C}_-\text{V.CV} \\
\text{CVCC} & \rightarrow \text{CV.C}_-\text{V.CV}
\end{align*}
\]

Compared with the CVC structure, a different constraint is at play.

\[
\text{(22) } *\text{CC}
\]

Assign one violation mark for every consonant cluster.

When \( *\text{CC} >> \text{Dep-V} \), epenthesis is triggered.

\[
\text{(23)}
\]

<table>
<thead>
<tr>
<th>/glu/</th>
<th>*CC</th>
<th>Dep-V</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ( \rightarrow ) k̄lu</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>b. klu</td>
<td>*!</td>
<td></td>
</tr>
</tbody>
</table>

Similarly the constraints posited to account for the CVC structure are at play.
To sum up, the constraint ranking for Mandarin accented English is as follows:

(25) *CC, NoObsCoda, Agree[+fric], Agree[+hi, -bk], Agree[lab], *fy >> Dep-V

4.7. The counterexample

However, an undesirable optimal output appears under such ranking:

(26)

[pʰ.a.pʰ] wins out while the correct optimal output is [pʰ.a.pə]. If we compare the labial oral stops and labial fricatives, we run into an even more complicated situation.

(27)

For labial fricatives, the constraint works perfectly. By contrast, for labial oral stops, the
agree[lab] constraint can sometimes knock out the correct optimal output. We must incorporate some other constraints to account for such imbalance. Since labial oral stops and fricatives differ in manner of articulation, we can figure out a constraint that works only for oral stops. In addition, since the constraint ranking works well when the labial oral stop occurs in onset cluster and fails when the labial oral stop occurs in coda position, we can posit a positional markedness constraint $\mathcal{C}$ that ranks higher than Agree[lab] so that it can knock out the undesirable pub[u] before the Agree[lab] wrongly knocks out the desirable pub[ə].

\begin{center}
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline
 & $\mathcal{C}$ & *CC & NoObs & Agree [+fric] & Agree [+hi, -bk] & Agree [lab] & *fy & Dep-V \\
\hline
a. $\rightarrow$pub[ə] & & & & & * & * & \\
b. pub[u] & *! & & & & & & * \\
\hline
\end{tabular}
\end{center}

(28)

\begin{center}
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline
 & $\mathcal{C}$ & *CC & NoObs & Agree [+fric] & Agree [+hi, -bk] & Agree [lab] & *fy & Dep-V \\
\hline
a. $\rightarrow$b[u]lue & & No effect & & & & & * & \\
b. b[ə]lue & & & & & *! & & * \\
\hline
\end{tabular}
\end{center}

(29)

Whatever the constraint $\mathcal{C}$ is, it would be rather ad hoc since it is quite complicated to describe such a constraint.

4.8. A perceptual account

Broselow (2011) proposed that perception grammar is as important as production grammar in the understanding of loanword phonology. Perception grammar maps the acoustic signals to phonological representations whereas production grammar maps the phonological representations to phonetic representations. Not much work in theoretical phonology so far has focused on perception grammar. Dupoux et al. (1999) argued that epenthesis has a perceptual origin. In their experiment, the input /ebzo/ is perceived faithfully as [ebzo] by French speakers but as [ebru] by Japanese speakers. The epenthetic vowel comes from the perception grammar of Japanese speakers. Likewise, we can hypothesize that Mandarin
speakers may perceive /pʰʌb/ as [pʰaŋ] and /blu/ as [pulu]. Such hypothesis must be attested by empirical evidence. Therefore we will leave it for future research.

5. Conclusion

The epenthetic vowels in Mandarin accented English are influenced by the preceding consonant. The markedness constraint Agree[feature] as well as a *fy constraint motivate the epenthetic vowels to be context-dependent. While all the markedness constraints have no effect on the epenthetic vowel, a default schwa is inserted. For any English input that contains a labial oral stop in coda position, there is always an epenthetic schwa in the output, which cannot be accounted for by the constraint ranking constructed in this paper. A sound analysis may have to resort to the perception grammar of Mandarin speakers.

References


