How L1 Phonological Transfer in Chinese EFL Learners Can Inform Mandarin Phonological Structure

Chris Wen-Chao Li*
Department of Foreign Languages and Literatures, San Francisco State University
1600 Holloway Avenue, San Francisco, California 94132-4163, U.S.A.

ABSTRACT

There have been many studies to date of pronunciation errors made by Chinese learners of English, the majority of which focus on the causes of these errors via native language transfer and focus on exploring pedagogical implications. This paper takes the same learner data and looks instead at what these errors say about the respective phonological structures of native and target language. Specifically, the paper focuses on two controversial areas of Mandarin phonology – phonemic designation of the alveopalatal initials and rime structure within the syllable, and argues for the use of Chinese learners’ English pronunciation errors as evidence to inform the choice between competing models of Mandarin phonological structure.

Regarding Mandarin rime structure, it will be shown that the inability of Mandarin native speakers to produce diphthongs in closed syllables favors models of Mandarin syllable structure in which both the nucleus and the coda are non-branching. The fact that single slots only are assigned to the nucleus and the coda forces the reduction of the target language VGC sequence through either monophthongization or coda deletion.

Regarding the phonemic status of the Mandarin alveopalatals, it will be shown that the tendency for Mandarin speakers to convert English “s” into the Mandarin voiceless alveopalatal fricative [ɕ] before high front vowels offers strong evidence that the alveopalatals may be allophonic with the alveolar sibilants. Furthermore, the absence of errors stemming from the combination of velar consonants with high front vowels strongly suggests that the alveopalatals cannot be allphonic with the velars.

In introducing evidence from Chinese EFL errors, this study invokes a new strategy with which to probe the phonological structure of Chinese. It is believed that, as a systematic, natural and fully involuntary phenomenon, L1 transfer errors should be given greater weight in determining the psychological reality of theoretical linguistic constructs.

KEYWORDS: phonemicization; syllable structure; interlanguage; L1 interference

* Tel.: 001 415 338 1034; E-mail: wenchao@sfsu.edu
OUTLINE

1. Introduction
   a. Perspectives on L1 transfer
   b. Key issues
      i. Mandarin rime structure
      ii. Status of the Mandarin alveopalatals

2. Mandarin rime structure
   a. Proposed rime structures
   b. Evidence from Mandarin L1 transfer
   c. Parallels in neighboring languages (Cantonese, Vietnamese)

3. Status of the Mandarin alveopalatals
   a. The issue of complementary distribution
   b. Proposed groupings
      i. Alveopalatals as allophones of the velars
      ii. Alveopalatals as allophones of the alveolar sibilants
      iii. Alveopalatals as an independent series
   c. View from interlanguage phonology
      i. Alveopalatals as allophones of the velars
      ii. Alveopalatals as allophones of the alveolar sibilants
      iii. Alveopalatals as allophones of the retroflex initials
      iv. Alveopalatals as an independent series

4. Discussion
1 Introduction

There have been many studies to date of pronunciation errors made by Chinese learners of English as a second language (ESL) or English as a foreign language (EFL), the majority of which focus on the causes of these errors via native language transfer and/or phonological markedness, and seek to address these imperfections as part of fine-tuning the language acquisition process (Ho 2003; An 2007; S. Chang 2008; Tseng 2008; Huang and Radant 2009; Yao 2009; Tsai 2011). That is to say, existing studies see inconsistencies between the phonological structures of native (L1) and target (L2) languages as giving rise to imperfect acquisition of target language phonology, and for the most part focus on exploring the pedagogical implications of such a structural incompatibility.

This paper takes the same learner data and turns the question around, looking not at how best to correct non-native pronunciation, but instead on what these learner errors say about the respective phonological structures of native and target language. Specifically, the paper focuses on two controversial areas of Mandarin phonology – phonemic designation of the alveopalatal initials and rime structure within the syllable, and argues for the use of Chinese learners’ English pronunciation errors as evidence that will inform the choice between competing models of Mandarin phonological structure.

Regarding Mandarin rime structure, it will be shown in Section 2 of the paper that the inability of Mandarin native speakers to produce diphthongs in closed syllables (e.g., English “rain”, “town”) works against models of Mandarin syllable structure which allow a branching nucleus (Chung 1989, 1996; Lin 1989, 2007) or branching coda (C. Cheng 1973), and favors models in which both the nucleus and the coda are non-branching. The fact that single slots only are afforded the nucleus and the coda forces the reduction of the target language VGC sequence through either monophthongization (VC) or omission of the coda (VG), as observed in the interlanguage pronunciation of Chinese ESL/EFL learners. Furthermore, it is shown that the phenomenon is not unique to Mandarin – speakers of languages with similar syllable structures, such as Cantonese and Vietnamese, also exhibit the same behavior with respect to rime simplification.

Regarding the long-debated phonemic status of the Mandarin alveopalatal initials, it will be shown in Section 3 that the tendency for Mandarin speakers to replace English “s” with the Mandarin voiceless alveopalatal fricative [ɕ] in the environment of high front vowels (e.g., “see”, “city”) offers strong evidence that the alveopalatalals may be allophonic with the alveolar sibilants in Mandarin. Furthermore, the conspicuous absence of errors stemming from the combination of velar consonants with high front vowels (e.g., “key”, “hip”) strongly suggests that the alveopalatalals are not allphonic with the velar series of consonants, as suggested by Chao (1934) and R. Cheng (1966).

In using Chinese ESL/EFL errors to shed light on Mandarin segmental and suprasegmental structure, this study invokes a new strategy with which to probe the phonological structure of Chinese, to be used alongside traditional sources of evidence such as segmental distribution, slips-of-the-tongue, language games, onomatopoeic expressions, and traditional poetic rhyme and alliteration. It is believed that, as a systematic, natural and fully involuntary phenomenon, L1 transfer errors provide greater insight into linguistic constructs in the mind than forms of evidence based on artificial learning or literary traditions, and as such should be given greater weight in determining the psychological reality of underlying linguistic structures.
2 Mandarin rime structure

There is general agreement that Mandarin Chinese allows a maximally four-position syllable structure of (C)(G)V(G) or (C)(G)V(N), as shown in Figure 1. Furthermore, regardless of theoretical orientation, there is broad consensus that the structure from the nucleus (V) onwards constitutes the rime substructure of the syllable.

Excluding for now syllables containing the diminutive r-suffix, Mandarin rimes are of two types: basic rimes which contain an underlyingly empty coda following the nucleus (e.g., [aː]), and complex rimes in which the coda position is non-empty (e.g., [an] 安). In this paper we will concern ourselves only with the Mandarin complex rimes, the positioning of whose subsyllabic components lie at the heart of the hierarchical structure of the Mandarin syllable.

Mandarin complex rimes allow two possible configurations: the nucleus-glide (VG) configuration, which includes four possible rimes [aj], [aw], [ǝj], [ǝw] (as in the lexemes 海、好、黑、後), and the nucleus-nasal (VN) configuration, which includes another four rimes [an], [aŋ], [ǝn], [ǝŋ] (as in the lexemes 含、航、很、橫).

2.1 Proposed rime structures

There have been various proposals regarding how best to incorporate these two rime configurations within an overarching hierarchical constituent structure of the Mandarin syllable. C. Cheng (1973: 11), without giving additional argument, proposes that glide and nasal ending occupy neighboring positions within the coda constituent, as illustrated in Figure 2. As expanded upon in Figures 3 and 4, under C. Cheng’s model, VG rimes and VN rimes are represented by fundamentally different hierarchical trees, reflecting a structural difference which one would expect to lead to differences in phonological behavior, no evidence for which is presented by the author. Furthermore, in C. Cheng’s model, both the VG rime and the VN rime contain unoccupied slots that are unaccounted for.
Lin (1989: 27; 289; 2007: 108-109), on the other hand, argues for a structure in which the post-nuclear glide (G) is treated as a branch of the nucleus, whereas the syllable-final nasal (N) occupies the coda position, citing evidence from labial co-occurrence constraints and language game rules in Taiwanese, Cantonese, and Hakka dialect as justification. As shown in Figure 5, Lin’s structure is one with a potentially branching nucleus, whereas the coda position allows only a single consonant – nasal consonants in the case of Mandarin, and expanded to include stops in the majority of the southern Chinese dialects. Lin’s rime structure serves to explain why in the southern Chinese dialects labial initials may co-occur with post-nuclear labial glides (e.g., /paw/), but not with post-nuclear labial nasals and stops (e.g., */pam/, */map/). But as with C. Cheng’s model, the proposed structure contains unoccupied slots that are unaccounted for in the theory.
In addition to models of Mandarin rime that assign post-nuclear glide and nasal coda to different slots (resulting in the obligatory presence of an unoccupied slot at all times), the majority of models of the Mandarin syllable allow syllable-final G and syllable-final N to occupy the same slot, that is, a single coda slot, as shown in Figure 8. Under this configuration, VG rimes and VN rimes enjoy the same structure – one which does not result in the presence of an empty slot within the syllable, as illustrated in Figures 9 and 10.
2.2 Evidence from L1 phonological transfer

We have shown in the previous section that there are various hierarchical models of the Mandarin rime, some of which result in obligatory empty slots in the description of the two types of Mandarin complex rimes, and others for which there are no such unoccupied positions. In this section we apply evidence from the interlanguage phonological patterns of Taiwanese\(^1\) EFL learners to support the latter structure over the former. More specifically, we argue that the inability of Mandarin native speakers to combine diphthong and consonantal coda within the same syllable supports the hypothesis that there is no unoccupied slot in Mandarin VG or VN rimes, and that both nucleus and coda are non-branching in Mandarin Chinese.

There is abundant evidence in the literature that while Mandarin speakers have no problems pronouncing English diphthongs in open syllables, modifications occur in interlanguage speech when the same diphthongs occur in closed syllables.

Huang and Radant (2009: 152) note that while “Taiwanese EFL students can articulate [ej] correctly in words such as play and bay; strangely, it is quite common that they pronounce lake as [lɛk] or tape as [tʰɛp]”. The authors go on to point out in their data that “lame is pronounced [lɛm]; safe is pronounced [sɛf]; sale is pronounced [sɛl]; sane is [sɛn]”, and that “town is pronounced [tʰaŋ]” (2009: 153).

S. Chang (2008), focusing exclusively on the pronunciation of the English diphthong [ej], found that closed syllables inhibited accurate pronunciation of [ej] in Taiwanese EFL learners, while open syllables promoted accurate pronunciation (2008: 45). Seeking an explanation via contrastive analysis, she attributed the discrepancy to the fact that [ej] appears only in open syllables in Mandarin (2008: 12-13; 61-62), without delving deeper into the effects of syllable structure or rime structure.


Applying the three models of rime structure introduced in the previous section to this phenomenon, we find that while diphthongs such as [ej] or [aw] are compatible with all three structures, in the manner shown in Figures 2, 5, and 8, sequences of diphthong plus nasal vowel are unlicensed by the non-sub-branching rime structure, but remain possible in models with a branching nucleus or branching coda.

Take the English word “sane” [sejn] for example (vis-a-vis Huang and Radant 2009: 153). Figure 11 shows that the rime [ejn] should have no trouble fitting into C. Cheng’s branching coda structure, while Figure 12 shows that the same rime is compatible with Lin’s branching nucleus structure.

---

\(^1\) “Taiwanese” is used here as a reference to place rather than language. Where the usage occurs in this paper, the intended referent is Mandarin speakers from Taiwan, rather than speakers whose native language is Taiwanese Southern Min.
Were we to attempt to fit the same rime [ejn] into a single-nucleus, single-coda rime model however, we run into a problem: following nucleus [e], there remains only one licenseable slot. As shown in Figures 13 and 14, the one remaining slot can accommodate either glide [j] or nasal [n], but not both. The model predicts that Mandarin native speakers (and speakers of languages with similar syllable structure restrictions) will reduce the rime [ejn] to either [ej] or [en], the latter of which is observed by S. Chang (2008) and Huang and Radant (2009) in Taiwanese EFL learners.
Similarly, were we to look at the English word “town” [təwn] for example (vis-a-vis Huang and Radant 2009: 153), Figure 15 shows that the rime [əwn] should have no trouble fitting into C. Cheng’s (1973) branching coda structure, and Figure 16 shows that the same rime is compatible with Lin’s (1989; 2007) branching nucleus structure.

![Fig. 15 Rime [əwn] positioned within C. Cheng’s (1973) model of Mandarin rime](image1)

But when we attempt to fit the same rime [əwn] into a single-nucleus, single-coda rime model however, we see in Figures 17 and 18 that the one remaining slot following the nucleus can accommodate either glide [w] or nasal [n], but not both. The model again predicts that speakers of languages with such syllable structure restrictions will reduce the rime [əwn] to either [aw] via coda deletion, or [an] via monophthongization. We have seen in the previous example that between these two options Taiwanese EFL learners appear to show a preference for the monophthongization strategy, which has been observed by An (2007) and Huang and Radant (2009) in the case of [əwn]. But in this particular rime, monophthongization produces [an], which is not a legitimate syllable in Mandarin – the nearest approximations being [an] and [ən]. Assuming that preservation of vowel features in the obligatory nucleus takes precedence over preservation of coda features, we predict that the CORONAL articulator in [n] will be replaced with DORSAL to produce [ŋ], resulting in rime [əŋ], as illustrated in Figure 19. Thus the pronunciation of English “down” as 豆 [dəŋ]. The transformation is described by An (2007: 61) as a two-step process involving monophthongization and velarization.
Fig. 17 Forcing rime [awn] into a single-nucleus, single-coda rime structure via coda deletion

Fig. 18 Forcing rime [awn] into a single-nucleus, single-coda rime structure via monophthongization

Fig. 19 Forcing rime [awn] into a single-nucleus, single-coda rime structure via monophthongization and coda tweaking
2.3 Parallels in neighboring languages

In the previous section, it was pointed out that out of the three proposed hierarchical models of the Mandarin rime, only the model that stipulates that neither nucleus or coda be branching explicitly predicts that native speakers of Mandarin would be incapable of producing diphthong in closed syllables, despite the fact that Mandarin speakers have no trouble producing those same diphthongs in open syllables. Furthermore, it was predicted that when Mandarin speakers encounter diphthong plus consonantal coda sequences, there would be two possible strategies for bringing the foreign sequence in line with native language syllable structure, that is, (1) monophthongization, or (2) coda deletion. Taiwanese EFL learners were shown to favor the monophthongization strategy.

We find, however, in neighboring languages with similar syllable structures as Mandarin that although the same prohibition of diphthongs in closed syllables hold, adaptation strategies may differ.

Cantonese, which expands the Mandarin rime repertoire to VG, VN and VC by allowing stops [p], [t], [k] and the bilabial nasal [m] in the coda position, also prohibits diphthongs in closed syllables. L. Chang (1975: 232-233) notes that “Cantonese diphthongs occur only in the final position, i.e., in open syllables”, and as a result, Cantonese speakers have trouble producing English diphthongs with full glide in closed syllables.

When faced with English diphthongs in closed syllables, errors made by Cantonese speakers fall into two main categories: Figure 20 shows the use of a monophthongization strategy similar to that adopted by Taiwanese speakers, through which “same” is reduced to [sem], and “home” is reduced to [hom] – an error referred to by Chang as that of the “incomplete glide” (1975: 233). Figure 18 illustrates the second strategy predicted by our syllable structure model, namely “omission of the final consonant” (L. Chang 1975: 233), according to which “out” becomes [aw], “time” becomes [taj], and “five” becomes [fai] via deletion of the final consonants [t], [m] and [v]. Cantonese speakers, it would appear, avail themselves of both monophthongization and coda deletion strategies when presented with English syllables incompatible with their native syllable structure.

<table>
<thead>
<tr>
<th>Gloss (ENG)</th>
<th>Target language pronunciation</th>
<th>Interlanguage pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>same</td>
<td>sejm</td>
<td>sem</td>
</tr>
<tr>
<td>home</td>
<td>howm</td>
<td>hom</td>
</tr>
</tbody>
</table>

Fig. 20 Incomplete glides in the pronunciation of Cantonese EFL learners (L. Chang 1975: 233)

<table>
<thead>
<tr>
<th>Gloss (ENG)</th>
<th>Target language pronunciation</th>
<th>Interlanguage pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>out</td>
<td>awt</td>
<td>aw</td>
</tr>
<tr>
<td>time</td>
<td>tajm</td>
<td>taj</td>
</tr>
<tr>
<td>five</td>
<td>fajv</td>
<td>faj</td>
</tr>
</tbody>
</table>

Fig. 21 Incomplete codas in the pronunciation of Cantonese EFL learners (L. Chang 1975: 233)

In Figure 22, we see data from Vietnamese – another language in which most diphthongs occur only in CV structures (Hansen 2001: 339). As would be predicted by the single-nucleus, single-coda model of the rime, Vietnamese EFL speakers have trouble producing English diphthongs in closed syllables (Benson 1988: 226-228). The strategy with which native Vietnamese speakers adapt these problematic syllables, however, appears to be heavily

1489
lean towards final consonant deletion. As documented in Benson (1988: 228), Vietnamese
speakers delete the final consonant of any syllable that contains a diphthong, such that
English “like” becomes [laj], “out” becomes [aw], and “late” becomes [lej]. Within the
options presented by the transfer of L1 syllable structure, Vietnamese speakers appear to
exhibit a universal preference for the open syllable.

<table>
<thead>
<tr>
<th>Gloss (ENG)</th>
<th>Target language pronunciation</th>
<th>Interlanguage pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>like</td>
<td>lajk</td>
<td>laj</td>
</tr>
<tr>
<td>right</td>
<td>aajt</td>
<td>aaj</td>
</tr>
<tr>
<td>out</td>
<td>awt</td>
<td>aw</td>
</tr>
<tr>
<td>down</td>
<td>dawn</td>
<td>daw</td>
</tr>
<tr>
<td>late</td>
<td>lejt</td>
<td>lej</td>
</tr>
<tr>
<td>eight</td>
<td>ejt</td>
<td>ej</td>
</tr>
</tbody>
</table>

Fig. 22 Incomplete codas in the pronunciation of Vietnamese EFL learners (Benson 1988: 228)

In the preceding sections, we were able to show that out of the many competing models of the
Mandarin syllable, only one type of model, namely, those in which both nucleus and coda are
non-branching, are able to correctly predict the types of L1 transfer errors likely to be made
by native speakers of Mandarin when encountering English syllables of a structure
incompatible with the native language. The presence of the full range of possible strategies
for bringing the foreign syllable structure in line with the native language in English
pronunciation errors made by native speakers of Mandarin, Cantonese, and Vietnamese lend
further support to the psychological reality of the proposed syllable structure, showing that
patterns of L1 transfer in interlanguage phonology are a valuable source of evidence for the
existence of abstract structures in the mind.

3 Status of the Mandarin alveopalatals

The phonemic status of the Mandarin alveopalatal initials [ʨ], [ʨʰ], [ɕ] has long been an issue
of contention in Mandarin phonology, for the reason that with regard vowels and glides in
their immediate vicinity, the alveopalatals sit in complementary distribution with three other
initial series: the alveolar sibilants [ʦ], [ʦʰ], [s], the retroflex sibilants [ʂ], [ʂʰ], [ʂ], [ɻ], and
the velars [k], [kʰ], [x]. As a result there is little agreement to date on the phonemic status of
the Mandarin alveopalatal initials: expert opinion has been divided between treating the
alveopalatals as allophones of the velar initials (Chao 1934; R. Cheng 1966), treating the
alveopalatals as allophones of the alveolar sibilants (Duanmu 2000; Lin 2007), and viewing
the alveopalatals as an independent series altogether, albeit with accidental gaps in
distribution (Shi 1957; C. Cheng 1973; You, Qian and Gao 1980; Pulleyblank 1984; Y. Li
1984).

3.1 The issue of complementary distribution

Phonemic status has been traditionally conferred upon groupings of phones in a language
based on phonetic similarity and complementary distribution. The problem with the
alveopalatal initials [ʨ], [ʨʰ], [ɕ] in Mandarin is that they are phonetically similar to and
complementarily distributed with not one, but three potential series of initials – a condition
that has prompted Chinese linguist Yuen Ren Chao (1934) to ultimately reject the existence of
unique solutions in phonology as a practicable goal.
As we can see in Figure 23, the Mandarin alveopalatals [ʨ], [ʨʰ], [ɕ] occur only before the high front vowels [i] and [y] or their semivocalic counterparts [j] and [ɥ]; whereas the alveolar sibilants [ʦ], [ʦʰ], [s], the retroflex sibilants [ʈʂ], [ʈʂʰ], [ʂ], [ɻ], and the velars [k], [kʰ], [x] never occur before [i], [y], [j] or [ɥ]. That is to say, the alveopalatals occur exclusively in palatal environments, whereas the alveolar sibilants, the retroflex sibilants and the velars never occur in palatal environments. With regard to vocalic environment, the alveopalatals are in clear complementary distribution with the other three series. This, combined with the articulatory proximity and acoustic similarity of the alveopalatals to the velars, the alveolar sibilants, and the retroflex initials, makes it difficult not to assign allophonic status to the alveopalatals and group them together with one of the aforementioned initial series.

<table>
<thead>
<tr>
<th>vowel/glide vs initial</th>
<th>alveopalatal</th>
<th>velar</th>
<th>retroflex</th>
<th>alveolar sibilant</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>-</td>
<td>k, kʰ, x</td>
<td>tʂ, tʂʰ, ş, ɻ</td>
<td>tʂ, tʂʰ, s</td>
</tr>
<tr>
<td>i/j</td>
<td>tɕ, tɕʰ, ɕ</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>u/w</td>
<td>-</td>
<td>k, kʰ, x</td>
<td>tʂ, tʂʰ, ş, ɻ</td>
<td>tʂ, tʂʰ, s</td>
</tr>
<tr>
<td>y/ɥ</td>
<td>tɕ, tɕʰ, ɕ</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Fig. 23 Complementary distribution of the Mandarin alveopalatals with the velar, retroflex and alveolar sibilant initials

3.2 Proposed groupings

As a result of the complementary distribution of the Mandarin alveopalatals with the retroflex, velar and alveolar sibilant series of initials, various proposals have been advanced to identify the alveopalatals as allophones of one of these other series of Mandarin initials, though to date there is a lack of consensus regarding which series of initials the alveopalatals ought to be allophonic with, and evidence for the psychological reality of such groupings remains thin on the ground.

3.2.1 Alveopalatals as allophones of the velars

Despite renouncing the existence of biuniqueness in phonemic solutions, Chao (1934) eventually opted to treat the Mandarin alveopalatals as allophones of the velar initials, citing native speaker judgement of sound similarity and alveopalatal-velar interchangeability in Mandarin language games (Chao 1934: 48). Additional evidence ranging from etymological origin and alliterative onomatopoeic expressions to English-Chinese transliteration conventions has been cited to support the alveopalatal-velar affiliation (Fu 1956; R. Cheng 1966; Lin 1989).

According to this arrangement, the accidental gaps found in the distribution of the alveopalatals and the velar initials cancel each other out, whereas gaps remain in the distribution of the alveolar sibilant and retroflex initials, as shown in Figure 24.

<table>
<thead>
<tr>
<th>vowel/glide vs initial</th>
<th>velar</th>
<th>retroflex</th>
<th>alveolar sibilant</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>k, kʰ, x</td>
<td>tʂ, tʂʰ, ş, ɻ</td>
<td>tʂ, tʂʰ, s</td>
</tr>
<tr>
<td>i/j</td>
<td>tɕ, tɕʰ, ɕ</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>u/w</td>
<td>k, kʰ, x</td>
<td>tʂ, tʂʰ, ş, ɻ</td>
<td>tʂ, tʂʰ, s</td>
</tr>
<tr>
<td>y/ɥ</td>
<td>tɕ, tɕʰ, ɕ</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Fig. 24 Alveopalatals as allophones of the velar initials
A number of criticisms have been leveled at the treatment of the alveopalatals as allophonic variants of the velar initials. First, it is not clear that native speaker judgement favors the treatment of alveopalatals as velars in palatal environments – Chao (1934) failed to make clear what his claim of native speaker intuition was based on, and subsequent authors have gone on to claim that native speakers feel differently about alveopalatal affiliation (Shi 1957: 14; You, Qian, and Gao 1980: 333; Li 1984: 254; Duanmu 2000: 28, 87). Furthermore, alliterative onomatopoeic conventions have been shown to associate alveopalatals with not only velars, but also alveopalatal sibilants (Kuo 1994: 13; C. Li 1999: 94). Recent scholarship has also been careful to differentiate between historical roots and mental representations and derivations (C. Li 1999).

3.2.2 Alveopalatals as allophones of the alveolar sibilants

Another popular approach has been to group the alveopalatals [ʨ], [ʨʰ], [ɕ] with the alveolar sibilants [ʦ], [ʦʰ], [s]. Duanmu (2000) adopts such a grouping, basing his treatment on purported greater phonetic similarity and native speaker judgement (see also Lin 2007), plus the fact that in Beijing there is a tendency among certain young women to pronounce the alveopalatals as alveolar sibilants to affect a more feminine pronunciation (Cao 1987) – all of which leads him to conclude that the alveopalatals are best grouped with the alveolar sibilants.

If the Mandarin alveopalatals are identified with the alveolar sibilants, the accidental gaps found in the distribution of the alveopalatal and alveolar sibilant initials cancel each other out, whereas gaps remain in the distribution of the velar and retroflex initials, as shown in Figure 25.

<table>
<thead>
<tr>
<th>vowel/glide vs initial</th>
<th>velar</th>
<th>retroflex</th>
<th>alveolar sibilant</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>k, kʰ, x</td>
<td>tɕ, tɕʰ, ɕ, ɻ</td>
<td>ts, tsʰ, s</td>
</tr>
<tr>
<td>i/j</td>
<td>-</td>
<td>-</td>
<td>ts, tsʰ, ɕ</td>
</tr>
<tr>
<td>u/w</td>
<td>k, kʰ, x</td>
<td>tɕ, tɕʰ, ɕ, ɻ</td>
<td>ts, tsʰ, s</td>
</tr>
<tr>
<td>y/ɥ</td>
<td>-</td>
<td>-</td>
<td>tc, teʰ, ɕ</td>
</tr>
</tbody>
</table>

Fig. 25 Alveopalatals as allophones of the alveolar sibilants

3.2.3 Alveopalatals as an independent series

There have to date been no proposals to merge the alveopalatals and the retroflex initials into a single phonemic series, despite the logical possibility of such an arrangement. The one exception is perhaps the MPS II (Mandarin Phonetic Symbols II -- 注音符號第二式) romanization system published in 1986 by the Ministry of Education of the Republic of China, which remains however a romanization convention that makes no claim to speaker intuition or psychological reality.

There have been nevertheless calls for treating the alveopalatal initials as an independent series, unaffiliated with the alveolar sibilants, the velars or the retroflex initials, the argument being that outside of distribution there is insufficient evidence to warrant any such grouping (Shi 1957: 14; You, Qian and Gao 1980: 333; Y. Li 1984: 254, 257). C. Cheng (1973: 38), for example, notes that much of the affiliation of the alveopalatals with the velars and alveolar sibilants is historical rather than synchronic in nature. Kuo (1994: 13) and C. Li (1999: 94) both point out that native speaker judgement and claims of affiliation extracted from alliterative onomatopoeic expressions and language game data are often conflicting. R. Cheng (1966: 142), in weighing the evidence for allophony presented in the literature, concludes that...
“it remains to be investigated whether the phonemes established on these criteria are in accordance with the phonemes taken to represent perceptual units of the native speaker”.

3.3 The view from interlanguage phonology

Having reviewed the insufficiency of evidence in the literature used to shed light on the phonemic status of the Mandarin alveopalatal initials, we now turn to patterns in the interlanguage phonology of Chinese EFL learners for new insight. More specifically, we will examine each of the three possible allophonic groupings mentioned in the previous section, and ask whether there is evidence from L1 phonological transfer in Chinese learners of English to support or refute such a stipulation.

3.3.1 Alveopalatals as allophones of the velars

Let us begin with the claim that the alveopalatals [ʨ], [ʨʰ], [ɕ] are allophones of the velars [k], [kʰ], [x] in palatal environments. As illustrated in Figure 24, such a hypothesis would assume that [k], [kʰ], [x] will always be pronounced as [ʨ], [ʨʰ], [ɕ] before palatal vowels.

Applied to the learning of English pronunciation, the hypothesis would predict that Chinese EFL and ESL learners might have trouble pronouncing sequences of velar (including glottal [h]) onset plus vowel [i] or [ɪ], as they would be inclined to replace [g], [k] and [h] with alveopalatals in palatal environments. For example, “give” would be pronounced as [ʨɪv], “keep” would be pronounced as [ʨʰɪp], and “hip” would be pronounced as [ɕɪp]. The literature on the interlanguage phonology of Mandarin EFL learners has noted no such velar conversions.

Furthermore, the said hypothesis would predict that, due to conversion of velars into alveopalatals before high front vowels, there be potential confusion in Mandarin learners between minimal pairs such as “keep” vs “cheap”, or “gear” vs “jeer”. Again, no such confusion is recorded in the literature. (NOTE: Ho (2003: 145) writes of confusion between the pronouns “he” and “she”, but it should be noted that the confusion is lexical rather than phonological in nature, due to its failure to apply across the board to all instances of the syllables [hi] and [ʃi]. Tseng (2008: 86) has also observed mispronunciations of [g] as [ʤ] and vice versa, but this is most likely due to the ambiguity of the phonetic form of the letter “g” in English spelling).

The absence of phonemic replacements and pattern confusions in English language acquisition that would be predicted by an allophonic grouping of the alveopalatals with the velars leads us to conclude that the Mandarin alveopalatals cannot be allophones of the velar initials. The fact that native speakers of Mandarin are able to produce sequences of velar plus high vowel (e.g., “key”, “give”) shows that the lack of such combinations in Mandarin are to be interpreted as strictly accidental gaps that can be attributed to historical development, and are not part of the phonotactics of the native language.

3.3.2 Alveopalatals as allophones of the alveolar sibilants

Let us now examine the claim that the alveopalatals [ʨ], [ʨʰ], [ɕ] are allophones of alveolar sibilants [ʦ], [ʦʰ], [s] in palatal environments. As was shown in Figure 25, such a hypothesis would assume that [ʦ], [ʦʰ], [s] will always be pronounced as [ʨ], [ʨʰ], [ɕ] before palatal vowels.

Applied to English pronunciation, the hypothesis would predict that Chinese EFL and ESL learners would have trouble pronouncing [s] before the vowel [i] or [ɪ]. That is to say, they
would have trouble pronouncing “see” or the letter “C”, instead producing [ɕi].

The pronunciation of the English letter “C” as [ɕi] has been observed in beginner-level Chinese EFL learners by many authors (Yao 2009: 293; Tsai 2011:31-33), and is seen as one of the most salient flaws of Chinese-accented English – a major focus of accent reduction classes. Viewed from another angle, however, the replacement of [si] with [ɕi] offers strong evidence of the affiliation between [s] and [ɕ], that is, between the alveolar sibilants and alveopalatals. The fact that Chinese native speakers do not pronounce “he” as [ɕi], but do pronounce “see” as [ɕi] offers evidence that the Mandarin alveopalatals are allophones of the alveolar sibilants, and not allophones of the velars.

3.3.3 Alveopalatals as allophones of the retroflex initials

We now examine the third logical possibility, i.e., that of the alveopalatals [ʨ], [ʨʰ], [ɕ] being allophones of the retroflex initials [tʂ], [tʂʰ], [ʂ] in palatal environments. As shown in Figure 26, such a hypothesis would assume that retroflex [tʂ], [tʂʰ], [ʂ] would be pronounced as [ʨ], [ʨʰ], [ɕ] before palatal vowels.

<table>
<thead>
<tr>
<th>vowel/glide vs initial</th>
<th>velar</th>
<th>retroflex</th>
<th>alveolar sibilant</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>k, kʰ, x</td>
<td>tʂ, tʂʰ, ʂ, ɕ</td>
<td>tʂ, tʂʰ, ʂ</td>
</tr>
<tr>
<td>i/y</td>
<td>-</td>
<td>ʨ, ʨʰ, ɕ</td>
<td>-</td>
</tr>
<tr>
<td>u/w</td>
<td>k, kʰ, x</td>
<td>tʂ, tʂʰ, ʂ, ɕ</td>
<td>tʂ, tʂʰ, ʂ</td>
</tr>
<tr>
<td>y/q</td>
<td>-</td>
<td>ʨ, ʨʰ, ɕ</td>
<td>-</td>
</tr>
</tbody>
</table>

Fig. 26 Alveopalatals as allophones of the alveolar sibilants

The problem with testing this hypothesis, however, is that in languages for which there is likely to be Chinese learner data, English included, sequences of retroflex onset plus high front vowel are rare. Retroflex consonants are rare to begin with in the languages of the world. In English, the closest we can get to a retroflex consonant is the English palato-alveolar series [ʤ], [ʧ], [ʃ] – which Chinese learners do have some trouble pronouncing, and use sounds from their native phonological inventory to replace. But the type of replacement rendered appears to differ with the type of Mandarin spoken.

Chen (1999: 95) noticed in speakers of Taiwan Mandarin that “the English segments /ʤ, ʧ, ʃ/ have their counterparts in Mandarin /ʨ, ʨʰ, ɕ/. Their phonological similarity induces the participants to establish correspondences between the target sound and their Mandarin counterparts”. The same is observed in American-born Taiwanese, who have the tendency to pronounce Mandarin [ʨ], [ʨʰ], [ɕ] as English [ʤ], [ʧ], [ʃ] (Young 2007: 91; 98-106). Note that the Mandarin alveopalatals [ʨ], [ʨʰ], [ɕ] have a place of articulation that is further back than English [ʤ], [ʧ], [ʃ], but like their English counterparts, are produced using a laminal gesture.

In speakers of northern Mandarin, however, the tendency often is to replace English [ʤ], [ʧ], [ʃ] with Mandarin retroflex [tʂ], [tʂʰ], [ʂ]. Experiments done by Chang et al (2011: 30-32) show that native speakers of Mandarin often were not able to maintain a reliable distinction between Mandarin [ʂ] and English [ʃ] (Chang et al 2011: 30-32). The authors also contend that the English palato-alveolars [ʤ], [ʧ], [ʃ] are acoustically closer in terms of centroid frequency to the Mandarin retroflex initials [tʂ], [tʂʰ], [ʂ] than to the Mandarin alveopalatals initials [ʨ], [ʨʰ], [ɕ]. Note that the Mandarin retroflex initials [tʂ], [tʂʰ], [ʂ] share the same palato-alveolar place of articulation with English [ʤ], [ʧ], [ʃ], but differ from their English counterparts in terms of tongue configuration.
With regard to the possibility of the Mandarin alveopalatal initials being allophones of the retroflex initials, we are left without a clear conclusion due to the lack of foreign language retroflex plus [i] vowel sequences on which to base our observation of learner reflexes. But in observing adaptations of the English palato-alveolars [ʤ], [ʧ], [ʃ], we are made aware that speakers of different dialects of Mandarin may have distinct underlying phonological systems that manifest themselves in the phoneme replacements made when faced with a foreign sound. That is to say, there remains the possibility that the phonemic status of the alveopalatal initials [ʨ], [ʨʰ], [ɕ] may be different in Taiwan Mandarin than, say, in Beijing Mandarin.

3.3.4 Alveopalatal initials as an independent phonemic series

There remains to be examined the hypothesis that the alveopalatal initials [ʨ], [ʨʰ], [ɕ] remain an independent series unaffiliated with the alveolar sibilants [ʦ], [ʦʰ], [s], the velars [k], [kʰ], [x], or the retroflex initials [ʈʂ], [ʈʂʰ], [ʂ], [ɻ]. As was shown in Figure 23, such a hypothesis would assume that the lack of alveopalatal initials in non-palatal environments and the absence of velars, alveolar sibilants and retroflex initials in palatal environments are all due to accidental gaps in phonemic distribution.

The assumption that all gaps in the distribution of alveopalatal, velar, retroflex and alveolar sibilant initials are accidental would predict that as Mandarin-speaking learners of English encounter foreign syllables that place into these gaps, they would have no trouble producing the sounds. This assumption has been proven to be true in the case of the velar initials (i.e., Chinese learners have no trouble pronouncing “key”, “give”), untrue in the case of the alveopalatal sibilants (Chinese learners often pronounce “see” as [ɕi]), and remains untested in the case of the retroflex initials due to lack of data. By virtue of these patterns of interlanguage phonological transfer, it is safe to conclude that the alveopalatal initials are not an independent phonemic series in Mandarin, nor are they allophones of the velar initials.

The most likely conclusion to draw from these results is that the alveopalatal initials are allophones of the alveolar sibilants in Mandarin, as theorized by Duanmu (2000).

4. Discussion

Neither of two conclusions reached in this paper, namely, (1) that the Mandarin rime consists of a single nucleus and a single coda, and (2) that the Mandarin alveopalatal initials are most likely allophonic with the alveolar sibilant series of initials, are new proposals, these views having been propounded by a number of leading scholars in the field for decades.

The paper contributes to the scholarship on these two issues however in the way in which the conclusions are reached. In the case of rime structure, the study goes beyond mere theoretical speculation to offer tangible evidence in the form of involuntary interlanguage transfer patterns; in the case of alveopalatal affiliation, the study sidesteps the subjectivity of self-proclaimed native speaker judgements, the indeterminacy of onomatopoeic alliterative expressions, and the artificial nature of language game conventions to offer concrete evidence in the form of predictions regarding what learners will and will not do when faced with foreign sound sequences. In both cases, the type of evidence introduced offers strong support for the psychological reality of the structures thus posited.

In this study we limit ourselves mainly to interlanguage phonological transfer patterns in EFL and ESL learners whose native language is Mandarin Chinese, and focus specifically on evidence with a direct impact on the determination of syllable structure and the phonemic status of the Mandarin alveopalatal initials. Given the wide spectrum of L1 phonological transfer phenomenon currently documented, it is not difficult to foresee how L1 transfer
patterns in Chinese learners may in the near future be used to elucidate linguistic structures beyond these two issues, and that L1 transfer patterns from speakers of other languages and dialects may in due time be cited as evidence to support hypotheses of phonological structure in languages other than Chinese.

REFERENCES


