Understanding Problems in Learning Mandarin Consonants by Monolingual Speakers of English

英语为母语的人普通话辅音学习中的若干问题

Hua Lin, Ph. D.

林 华 博士、副教授

Associate Professor

加拿大维多利亚大学语言学系

Department of Linguistics, University of Victoria,
P.O. Box 3045, Victoria, BC, Canada V8W 3P4
Luahin@uvic.ca

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Hua Lin, Ph. D.
Associate Professor
Department of Linguistics, University of Victoria,
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Luahin@uvic.ca

In the area of second language acquisition, the learning and teaching of the sound and sound system of a language present some of the most difficult challenges. Especially after the learner reaches puberty, it becomes increasingly rare for the learner to achieve accentless pronunciation even though he/she may go on to master the syntax (sentence structure) and morphology (word and word structure) of the target language. Language teachers and researchers alike have been baffled by what has been known as the 'Joseph Conrad Syndrome,' the phenomenon named after the famous Polish-British author Joseph Conrad who became completely proficient and a great master at written English, as is shown in his brilliantly-written novels in the English language, while retaining his heavy Polish accent throughout his life. The lack of success in learning L2 phonology has promoted some linguists to declare that the Critical Period Hypothesis that language learning ends in puberty applies only to phonology (Scovel 1988). It is for reasons such as these that the linguistic area of learning and teaching second language phonology has gradually emerged as an autonomous area in applied linguistics and has been among the fastest developing areas in linguistics. What we have learned in increasingly greater detail in this area is that contrastive linguistics which was popular in the 1950s and 1960s partially helps with unraveling the nature of sound acquisition; many other aspects, among which is the universal grammar, clearly play a non-trivial part (cf. Lin, in progress).

In this paper, I will try to explain some of the most common difficulties native English speakers encounter learning Mandarin consonants in light of the generative phonology and current theories in second language (L2) acquisition. I will analyze the

difficulties in terms of the feature system, consonant inventory and their distribution facts. Based on this analysis, I will then offer some practical suggestions to teachers of Mandarin for addressing these difficulties.

1   Understanding the Difficulties

Any experienced teacher of Mandarin-as-a-second-language (MSL) will have noticed that some of the Mandarin consonants that seem to be particularly challenging to native English speakers include, [ts, tsʰ, tɕ, tɕʰ, ɕ, tʂ, tʂʰ, ʐ, x, ÿ] in International Phonetic Alphabet (IPA), or <z, c, j, q, x, zh, ch, r, h, yu> in *pinyin*[1] (see Lin 2001, Chapter 2). However, why these consonants should cause problems is a question to which not every teacher of MSL knows the answer. According to Contrastive Analysis Hypothesis (Lado 1957), cross-linguistic differences will lead to learning difficulties. Many studies in second language acquisition have since confirmed that learners are more adept at perceiving L1 than L2 sounds (e.g., Best 1994, Best *et al.* 1988, Dupoux *et al.*1997, Harnsberger, J. 2001, Polka and Werker 1994, Strange 1995). Thus a good understanding in teaching a second language should start with a contrastive analysis of the mother tongue (L1) and the second language (L2), and immediate attention should be given to what the L1 has but is missing in the L2.

Traditionally, language teachers tend to focus on mismatches between individual segments (i.e., consonant and vowels) in L1 and L2. The picture is however much more complex. For one thing, mismatches can be in the smaller domain of the feature system and/or in the larger domain of position in the syllable. All can potentially cause problems.

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[1] In this paper, symbols enclosed within angle brackets are *pinyin* symbols while those in square brackets are IPA symbols.

Now let us first see how the system of Mandarin consonants contrasts with that of English. As there are a number of different native versions of English in the world, we will focus our analysis on the consonant system used in American English spoken in the general area of North America. By 'Mandarin', we mean, on the other hand, the Standard Chinese spoken natively in Northern China. Also, in our description of the sounds in the two languages, we will use IPA. *Pinyin*, even though it is useful representing Mandarin sounds, is not applicable to identify English sounds and therefore cannot serve our purpose of comparison here. For MSL teachers and learners who only know *pinyin*, a table of Mandarin consonants showing the *pinyin* and IPA correspondence is provided in the Appendix.

1.1   Featural Differences

Now let us begin by examining the consonantal system of the mother tongue (L1) English:[2]

Table 1 English Consonants

Manner	Place	Bilabial	Labiodental	Interdental	Alveolar	Alveopalatal	Palatal	Velar	Glottal
stop	[-vc]	p			t			k	ʔ
	[+vc]	b			d			g	
affricate	[-vc]					tʃ			
	[+vc]					dʒ			
fricative	[-vc]		f	θ	s	ʃ			h
	[+vc]		v	ð	z	ʒ			
nasal		m			n			ŋ	
liquid					l r				
glide		w					y		

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[2] Traditionally, the glide [y] is sometimes represented by the IPA symbol [j].

English has 23 consonants not counting the glides or the semi-vowels. From the viewpoint of MANNER OF ARTICULATION, English has two sets of obstruents (i.e., stops, affricates and fricatives). Each set is divided into two groups by the feature [voicing] (or [+/-vc] for short) that indicates the presence of the vibration of the vocal cords. In addition, English has nasals, liquids and glides. From the viewpoint of PLACE OF ARTICULATION, English uses a full range of sounds from bilabials in the front to the glottals at the back. Now let us see the consonantal system of the target language (L2) Mandarin:[3]

Table 2 Mandarin Consonants

Manner			Bilabial	Labiodental	Dental	Alveolar	Alveopalatal	Palatal	Velar
stop	[-vc]	[+a]	pʰ			tʰ			kʰ
		[-a]	p			t			k
affricate	[-vc]	[+a]			tsʰ		tʂʰ	tɕʰ	
		[-a]			ts		tʂ	tɕ	
fricative	[-vc]			f	s		ʂ	ɕ	x
	[+vc]						ʐ		
nasal			m			n			ŋ
liquid						l			
retroflex						ʁ			
glide			w					y ÿ	

Not considering the semi-vowel glides, Mandarin has the same number of consonants as English. And like English, Mandarin also has two sets of obstruents. However, unlike English, the stops and affricates in Mandarin are divided into two groups by the feature [aspiration] ([+/-a] for short) which involves a strong puff of air coming out of the lungs (rather than the vibration of the vocal cords). And unlike English,

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[3] Traditionally, the umlaut glade [ÿ] is sometimes represented by the IPA symbol [ɥ].

all obstruents in Mandarin except fricative [ʐ][4] are not voiced (i.e., [-voice] or [-vc] for short). The prominence of [aspiration] in Mandarin and the lack of it in English suggests possible problems in the learning of the feature [aspiration] by native English speakers. We will return to this point shortly. Other features that are found prominent in Mandarin but not so in English include [retroflex] and [palatalization]. The former involves the curl of the tip of the tongue backward while the latter involves the simultaneous retraction of the tongue body and raising it toward the roof (the hard palate) of the mouth. We will discuss the featural difference in more details shortly.

1.2   Segmental Mismatches

In addition to featural differences, Tables 1 and 2 shows that English is missing the Mandarin consonants highlighted in the following table:

Table 3 Mandarin Sounds Missing in English

Manner		Place	Bilabial	Labiodental	Interdental	Dental	Alveolar	Alveopalatal		Palatal	Velar	Glottal
stop	[-vc]	[+a]	pʰ				tʰ				kʰ	
stop		[-a]	p				t				k	ʔ
stop	[+vc]		b				d				g	
affricate	[-vc]	[+a]				tsʰ		tʃ	tʂʰ	tɕʰ		
affricate		[-a]				ts			tʂ	tɕ		
affricate	[+vc]						dʒ					
fricative	[-vc]			f	θ	s	s	ʃ	ʂ	ɕ	x	h
fricative	[+vc]			v	ð		z	ʒ	ʐ			
nasal			m				n				ŋ	
liquid							l	r				
retroflex							ɻ					
glide			w								y	ɥ

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[4] See Lin (2001) for a discussion on whether the difference between [ʂ, ʐ] is a matter of aspiration or voicing.

Looking vertically from left to right from the perspective of PLACE OF ARTICULATION, we can see that Mandarin has three major series of consonants that are either not found in English (such as the dentals and the palatals) or are not the same as their English counterparts (the alveopalatals).

1.2.1   Mandarin Dentals and the Feature [Aspiration]

The comparison between Tables 1 and 2 helps us understand why the two dental affricates [ts^h] and [ts] (or <c, z>), especially the aspirated [ts^h], are challenging for English speakers. While the Mandarin dental fricative [s] has a closely approximating counterpart in the alveolar fricative [s] in English and thus is not apparently problematic, the Mandarin dental affricates [ts^h] and [ts] do not have equivalents in English. Here one may argue that English does have [ts^h] and [ts] counterparts, they are found in the final consonants in words like *its* [ts] and *beds* [dz], and the presence of these sound sequences in English should presumably make it easier for the two Mandarin dentals to be learned. However, a closer look at the picture would suggest otherwise. The problem is, firstly, that the Mandarin dental affricates are wholesome phonemes rather than sequences of sounds. More importantly, the Mandarin dental affricates occur only *syllable-initially* while their English 'counterparts' occur only *syllable-finally*. Studies in L2 acquisition have found that position in the syllable can affect acquisition. More specifically, a consonant in syllable-final position is harder to learn than it is in syllable-initial position (Flege & Davidian 1984, Henly & Sheldon 1986, Anderson 1987). As is well-known, [aspiration] plays almost no role in syllable-final position in English. English stops such as [p, t, k], for instance, are unreleased in syllable-final position when they are aspirated

in syllable-initial position (e.g., *top* [tʰɔp¬] versus *pot* [pʰɔt¬])[5]. Thus, even though

English does have [ts] as in *its*, [ts] occurs only in syllable-final position and is never

aspirated.

In fact the problem with aspiration does not only exit with the Mandarin dental

[tsʰ]. Some native English speakers have trouble aspirating the syllable-initial [pʰ] as in

<péngyǒu> 'friend'. In stead of [pʰɤŋ] 'shed', for instance, they would utter [pɤŋ] 'not

necessary', neutralizing the contrast between the minimal pair. The culprit is once again

the prominence of aspiration in Mandarin which is not found in English. In phonetic

terms, there may well be a difference in the voice onset time (VOT) between the

aspirated English and the Mandarin [p]s. Due to the technical complexity of the topic and

keeping in mind the intended audience of this paper (i.e., Chinese-as-a-second-language

or CSL teachers), we will not address VOT here.

1.2.2   Mandarin Alveopalatals and the Feature [Retroflex]

Mandarin alveopalatals [tʂ, tʂʰ, ʂ, ʐ] (or <zh, ch, sh, r>) are another set of

consonants that seem to cause problems for English speakers. Comparing Tables 1 and 2,

we see that English has almost an identical set of alveopalatals, the only difference being

that the English affricates are differentiated by [voicing] while those in Mandarin

[aspiration]. Then why would English speakers have problems learning these Mandarin

'counterparts'? The answer is that the Mandarin set[6] has a [retroflex] feature that requires

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[5] Where the diacritic '¬' means the segment before is unreleased.
[6] Please note that not all Mandarin dialects have the [retroflex] feature on these
alveopalatals. Mandarin spoken in Taiwan, for instance, is characteristically devoid of

the curl of the tongue tip backward while the English set does not. That is, not considering the [voicing] versus [aspiration] difference, there is a difference between the two sets in tongue configuration. Here one may argue that [retroflex] as a secondary feature does exist in English. Examples are found in words such as *ca_r_*, *shi_rt_* and *bu_rst_*. However, once again, the crucial matter lies in distribution: the [retroflex] in English occurs only *post-vocalically*[7] (i.e., after a vowel) whereas the Mandarin retroflexed alveopalatals occur only pre-vocalically in syllable-initial position. Apparently, the distributional difference between Mandarin and English retroflex features is responsible for the difficulty English speakers have in learning the Mandarin retroflex sounds. Specifically, English speakers are not used to using the [retroflex] feature in the onset position. Here it is interesting to note that the post-vocalic retroflex feature in English seems to positively influence its speakers learning the Mandarin post-vocalic [ʁ] as in [ɤʁ] (<èr> 'two'), and on the other hand, the absence of the post-vocalic retroflex feature in Mandarin means that the Mandarin speakers will have trouble learning it in words such as *war* and *burst* in English.

1.2.3   Mandarin Palatals and the Feature [Palatalization]

Mandarin palatal obstruents [tɕ, tɕʰ, ɕ] (or <j, q, x>) are a set of consonants that have almost always been found to cause problems for native English speakers, especially those monolingual English speakers at the beginning stage of learning Mandarin. A

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this feature. In fact, this features most clearly identifies the Mandarin dialect spoken in Beijing.

[7] Pre-vocalically, English does have a retroflex *segment* [r] which does not have much bearing on our discussion on secondary features here and will therefore be ignored.

comparison between Tables 1 and 2 suggest that the problem is caused by two factors. One, English does not have palatal obstruents, and two, English misses palatalized sounds altogether. Unlike many other languages such as Spanish and the Slavic languages such as Russian that do use palatalization to a greater or lesser extent, English does not have it as a secondary feature on consonants. In fact, English speakers' problems with palatalization do not only occur in learning the palatals in Mandarin, but they also occur in their learning Mandarin words such as <nǐ> 'you'. The Mandarin [n] in <nǐ> 'you' is actually slightly palatalized in the shape of [nʸ] with a secondary palatalization feature. It seems that almost no monolingual native English speakers can either perceive or produce this [nʸ] at the beginning stage of learning.

1.2.4   Mandarin Velar [x] and Glide [ÿ]

Mandarin velar fricative [x] as in <hǎo> 'good' and glide[ÿ] as in <yuē> 'appointment' are two other consonants that cause problems for English speakers. The problem with [ÿ] is the same as the problem with the Mandarin umlaut vowel [ü][8], and is easily explicable since English in general lacks umlaut segments--front vowels or consonants that have the lip-rounding feature.

The difficulty English speakers experience in learning Mandarin [x] is more complex. A comparison of Tables 1 and 2 reveals that English does not have a velar fricative [x]. However, unlike most of the Mandarin consonants discussed previously that are simply hard for English speakers to duplicate, Mandarin velar [x] is usually conveniently and unwittingly replaced with the English glottal [h] by English speakers.

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[8] I will discuss the learning of Mandarin vowels by English speakers in another paper.

This replacement seems to be due to similarities rather than differences between the two consonants. Both sounds are in fact identical except for a slight difference in Place of Articulation, with Mandarin [x] being more to the front than the English [h]; that is, both have the exact manner of articulation--the same amount of aspiration and the same configuration of the tongue and the vocal and nasal cavities. In fact, the sameness does not only cause English speakers difficulties in learning the Mandarin sound, but it also causes the reverse problem for Mandarin speakers learning English; namely, Mandarin speakers substitute [x] for [h] when pronouncing English words such as *how, hear* and *hurry*. It is quite possible that neither English nor Mandarin speaker can perceive the difference between the two, especially at the beginning stage of the L2 learning, and the perception problem leads to the substitution of the L1 sound for the L2 one.

Although Contrastive Analysis Hypothesis claims that similarities between L1 and L2 features should facilitate learning the L2 feature, recent studies (e.g., Aoyama *et al*. 2004, Flege 1995) have demonstrated that given two sounds *x* and *y* in L2 that are similar to *z* in L1, learning the L2 *x* is faster than learning the L2 *y* if *x* is less similar to the L1 *z* than the L2 *y*. According to the much cited Speech Learning Model of Flege (1995), the greater the perceived phonetic dissimilarity between *x* in L2 and *z* in L1, the easier the learner can differentiate between the two sounds. What these studies suggest is that similarity to a certain degree may hinder rather than facilitate learning. In our case, this seems a perfect explanation for the confusion between [x] in Mandarin and [h] in English. The very close approximation between them leads to a lack in their discrimination and, consequently, difficulties in learning them by their respective L2 learners.

1.2.5   Mandarin Nasals [n] and [ŋ]

While the problems discussed so far can be more or less explained through contrastive differences between the features, individual sounds and their distribution in syllables in the two languages, there is one problem that seems to be quite baffling to linguists and language teachers. That is, English speakers often have trouble differentiating between [n] and [ŋ] in syllable-final position in Mandarin[9]. Mastery of the difference between minimal pairs such as [fɤn] (<fen>) and [fɤŋ] (<feng>) seems to require a great deal of training for English speakers. The problem is puzzling because both English and Chinese have these two consonants, and both sets occur in syllable-final position. For instance, English has minimal pairs such as *sin* and *sing*, *kin* and *king*, *ban* and *bang*, and *ran* and *rang*. What is even more bewildering is that Mandarin speakers also seem to have trouble with English [n] and [ŋ]. It is not unusual, for instance, to hear Mandarin speakers pronounce *sinful* as *singful*, and *done* [dʌn] as *dung* [dʌŋ]. The explanation does not apparently lie in comparing the two languages but rather, seems to come from something more general.

Huang (2003) noted in an auditory experiment that both English and Mandarin speakers tended to mis-perceive the velar nasal [ŋ] as the alveolar nasal [n]. For instance, they would hear [ɪŋ] as [ɪn] and [əŋ] as [ən]. Huang has suggested that the misperception is due to a general tendency for simplicity in language. The confusion of

[9] Neither Mandarin nor English has [ŋ] in syllable-initial position. By Mandarin we mean Standard Mandarin, as some Mandarin dialects (such as Jinan dialect of Shangdong Province) other than the Standard do have [ŋ] in syllable-initial position (Lin 2001).

the two nasals is reflected in other Chinese dialects as well. According Huang, the two are merging in Taiwan Mandarin into one [n]. In certain other Chinese dialects such as Chaozhou and Fuzhou, the merging direction is reversed, changing [n] into [ŋ] (Zee 1985). It thus seems that there may be a general tendency for the identities of the two sounds in concern to be confused and the presence of these sounds in a L1 does not guarantee success in learning the same sounds in a L2. Explanation may also reside in the difference in the phonotactic constraints each of the two languages places on these sounds. For instance, it seems that Mandarin [ŋ] can combine with more vowels and diphthongs than the English [ŋ]. The additional unfamiliar contexts in which Mandarin [ŋ] can occur may result in difficulties for English speakers trying to learn it. Secondly, it is possible that the two sets are simply not identical sounds from both articulatory and acoustic perspectives even though *categorically*, the Mandarin set is the equivalent to the English set. Further perception and production tests and acoustic analysis are needed to verify if this is indeed the case.

2 Practical Suggestions for Teachers of Mandarin

In this section, I will make some practical suggestions for teaching Mandarin consonants based both on the analysis and discussion in the previous section as well as on my own experience in teaching MSL. I will begin with the feature [aspiration]. Mandarin aspirated consonants that are frequently problematic for English speakers include (but are not necessarily limited to) [ts^h], [tʂ^h], [tɕ^h] and occasionally, [p^h] (or <c, ch, q, p>). The trick in teaching these sounds is to ask the student to pronounce the English glottal fricative [h] *simultaneously*. For instance, in teaching [ts^h], tell the student to say the

Mandarin [tsʰ] and the English [h] at the same time. Alternatively, the teacher may ask

the student to say repeatedly the English sentence: *Its horrible*, emphasizing on the

underlined part[10] so as to capture and secure the aspiration in [tsʰ].

Similar 'two-in-one' approach can be used in teaching the Mandarin palatal

consonants [tɕ, tɕʰ, ɕ and nʸ] (or <j, q, x, n>[11]). Like [h] in the aspirated Mandarin

sounds, the sound that should be 'incorporated' into the palatals is [i] (or more

specifically, its glide variation [y]). The teacher can start by pointing out that these

palatals are similar to the initial consonants in such English words as *jeep, cheap, sheep*

and *need*, respectively. Note that in all these words, the vowel is invariably [i], which is

the essential common element in a palatalized consonant (although [i] should not be

voiced). After the students become familiar with *jee(p)* for [tɕ]*, chea(p)* for [tɕʰ],

shee(p) for [ɕ] and *nee(d)* for [nʸ], ask them to say the initial consonant and the vowel [i]

simultaneously and avoid saying the consonant first followed by the vowel as they are

handled in English.

Teaching the Mandarin retroflex consonants [tʂ, tʂʰ, ʂ, ʐ] (or <zh, chi, sh, r>)

can be facilitated by asking the students to say English words such as *car*, *shirt*, *war* and

burst. The idea is for the students to find the common [retroflex] feature in these words in

the post-vocalic position and to pinpoint the configuration of the articulators (tongue and

oral cavity, etc.) in producing it. Once they are able to feel and identify this common

feature in these words, ask the students to try to add that feature to the Mandarin retroflex

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[10] I thank my colleague, Dr. Daniel Bryant, in the Pacific Asian Studies Department at the
University of Victoria, for teaching me this effective method.
[11] The consonant <n> is as in *nǐ* 'you'.

consonants. Alternatively, the teacher may ask the students to try and add that feature to the English counterparts [dʒ, tʃ, ʃ, ʒ] found in words such as *journal*, *church*, *shirt* and *genre*, respectively. Ask the students to say these four words by moving the post-vocalic retroflex [r] in these words forward right to the start of the initial consonant.

The Mandarin [x] can be taught by first asking the students to say the English [k] and [g] as found in the initial consonant in *cut* and *gut*. Ask them to feel where these two consonants are formed in the mouth. They should now be able to identify the position of the velum. Then ask the students to say the English [h] in that position, namely, in the same position as the one for producing English [k] and [g] (or Mandarin [kʰ] and [k], for that matter).

Finally, teaching the umlaut glide [ÿ] is the same as teaching the umlaut vowel [ü]. It entails the juxtaposition of the sound [u] together with the sound [i]. In practice, ask the students to hold fast the lip configuration of [u] while simultaneously pronouncing [i] behind the lips by the tongue. Alternatively, ask the students to start by saying [i] and keeping fast the [i] in position, tighten the lips into a circle as seen in pronouncing [u].

3   Conclusion

In this paper, I have attempted to explain, within the general guidelines of generative phonology and theories of second language acquisition, some of the well-observed difficulties English speakers experience in learning MSL consonants. I have shown that the difficulties mostly arise from mismatches between the two languages not only in consonant inventory, but also in featural system and distribution of the consonants

and features within the syllable (i.e., phonotactic constraints[12]). Based on the analysis and explanations, I have suggested methods for teaching the difficult Mandarin consonants. It is my hope that this paper will enhance the understanding of the process in learning Mandarin consonants by both MSL teachers and students and that the methods provided will help reduce the learning and teaching difficulties.

It should be noted here that not all English speakers will experience all the difficulties discussed in this paper and not all who experience the difficulties will experience them to the same degree. Individual difference in the learning experience can be attributed to many factors, with one of the most important being the students' knowledge of other languages. A student with knowledge of German, for instance, may have less trouble learning the Mandarin velar [x] than a student who is a monolingual English speaker. This is because German does have a similar velar sound found in the final consonant in such word as *Bach*. Also, an English speaker with knowledge of Spanish or Russian may have less trouble with the palatalized consonants in Mandarin due to the fact that palatalized sounds do occur in these languages. It is thus recommended that the MSL teachers or any teacher of a second language is aware of the students' background in languages before and during the teaching process.

It should also be noted that the degree and the kind of difficulties English speakers experience in learning Mandarin consonants may change over time as their MSL proficiency levels increase. Difficulties at the beginning stage--normally due to L1 and L2 differences--may diminish or disappear over time. On the other hand, what appears as

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[12] See Lin (2001) for more information on Mandarin phonotactic constraints.

less difficult at the beginning--normally due to L1 and L2 similarities--may take much longer time to master.

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Appendix

Mandarin Consonants
Correspondence between Pinyin and IPA

			Bilabial	Labiodental	Dental	Alveolar	Alveopalatal	Palatal	Velar
stop	-vc	-a	p <b>			t <d>			k <g>
		+a	p^h <p>			t^h <t>			k^h <k>
affricate	-vc	-a			ts <z>		tʂ <zh>	tɕ <j>	
		+a			ts^h <c>		$tʂ^h$ <ch>	$tɕ^h$ <q>	
fricative	-vc			f <f>	s <s>		ʂ <sh>	ɕ <x>	x <h>
	+vc						ʐ <r>		
nasal			m <m>			n <n>			ŋ <ng>
liquid						l <l>			
retroflex						ʁ <(e)r>			
glide			w <w>					y <y>	