Are the Mandarin retroflex initial consonants really retroflex? Are the palatals really palatal?... The notes on terminology

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The purpose of my paper is a detailed view of the terminology used for classifying the initial consonants of Mandarin.

When I was a student I made a great discovery: when I pronounce the palatals j, q, x, the body of my tongue should not be raised straight up, but instead, pushed a little more forward. It was a puzzle for me why are these sounds called palatals then? I made a similar „discovery” with the retroflexes - I was astonished to learn I should not bend my tongue backwards - eventhough these sounds are called retroflexes... So, in these old days you can find the motivations of my paper.

Introduction

The terms such as palatal, velar, retroflex etc. are used both in phonetic description - to capture the articulation of consonants, and in phonology - to classify the consonants within the system of a specific language (音位系统). If these terms are employed as phonological „labels“, only contrasting features are taken into account, while the phonetic details can be neglected.

According to Haynu piniyn fang´an, there are 21 initial consonant phonemes (shēngmǔ 声母) in Mandarin (putonghua).

b, p, m, f, d, t, n, l, z, c, s, zh, ch, sh, r, j, q, x, g, k, h

They can be arranged into several rows acording to their articulation. Most phonologists accept six rows.

<table>
<thead>
<tr>
<th>labial</th>
<th>唇音</th>
<th>b,  p,  f,  m</th>
</tr>
</thead>
<tbody>
<tr>
<td>alveolar</td>
<td>齿龈音</td>
<td>d,  t,  n,  l</td>
</tr>
<tr>
<td>dental</td>
<td>齿音</td>
<td>z,  c,  s</td>
</tr>
<tr>
<td>retroflex</td>
<td>卷舌音</td>
<td>zh,  ch,  sh, r</td>
</tr>
<tr>
<td>palatal</td>
<td>腭音</td>
<td>j,  q,  x</td>
</tr>
<tr>
<td>velar</td>
<td>软腭音</td>
<td>g,  k,  h</td>
</tr>
</tbody>
</table>

The row „palatal“ is sometimes missing, as some authors consider them to be allophones of either g, k, h (e.g. Chao 1934, Howie 1976, Hsiueh 1986), or z, c, s (e.g. Hartman 1944, Hockett 1947, Dragunov & Dragunova 1955, Duanmu 2002, Lin 2007).

Each of the rows has a name which in most cases is based on the place of articulation. Some names can be different with different authors, as I will show later. These „labels“ are not
always phonetically accurate. In my paper, I will first explore the articulatory properties of these rows in speech production. Then I will look at the labeling terms, as given by different authors, and try to find how accurately they express the articulation. Finally I will try to decide which term is the most appropriate.

Let us look at the system of the Mandarin consonants. The initial consonants can be arranged into a table which specifies the place of articulation and the manner of articulation. In italics I give the active articulator - the tongue. The affricates are in yellow. The table I am giving here is just a point of departure, as there are differences in analysis in the literature.

### Initial consonants of Mandarin

<table>
<thead>
<tr>
<th>PLACE OF ARTICULATION</th>
<th>MANNER OF ARTICULATION</th>
<th>plosives and affricates</th>
<th>fricatives</th>
<th>nasals</th>
<th>laterals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>non-aspirated</td>
<td>aspirated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>labials</td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>alveolars</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>apical</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dentals</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>apical</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>postalveolars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>apical retroflex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>palatals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dorsal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>velars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>dorsal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The names of the rows are given in bold. As we see, four rows are named according to the place of articulation, one according to the shape of the tongue, one according to the lips.

If we explore these consonants more closely, we find out the following problems:

1. Various authors do not always agree on the phonetic description (and also transcription) of particular rows. Let us take for instance, the row d, t, n, l and the row z, c, s. Somebody thinks the place of articulation of these two rows is slightly different, some think it is the
Another example: the row \textit{zh, ch, sh, r} is sometimes considered as \textit{postalveolar}, sometimes \textit{prepalatal}, sometimes \textit{alveopalatal}.

Of course, this is partly caused by the \textbf{objective problems} the phoneticians have to deal with. E.g.: how to specify the regions of articulation and where to draw a borderline between them? We know the reality is a continuum - there are no discrete places of articulation. This problem is discussed in Ladefoged & Wu 1984:277. Furthermore, there might be a problem with transcribing the sounds. The categories of the International Phonetic Transcription (IPA) do not represent any specific system - IPA should be usable for any language, so the tables cannot be overly detailed. Consequently, some categories have to be interpreted differently for different languages (for instance the category retroflex, as I will show later). Then, some categories we might need can be missing. For instance there is no column „alveopalatal“ in the main table - there are only two fricatives \textit{c, z} which are placed among \textit{other symbols}. Furthermore, the phoneticians have to handle the \textit{variability among the speakers}, which can be sometimes quite noticeable, yet is still acceptable within the norm.

2. While choosing a \textbf{phonological label}, different authors can take different routes of \textit{abstractions}. This is also true for the analysis of Mandarin. For instance, the row \textit{j, q, x} is sometimes termed \textit{palatal row} (according to the passive articulator), sometimes \textit{dorsal row} (舌面音 \textit{shémiàn yīn}) (according to the active articulator).

The result of these disagreements is a \textit{diversity in the terms} used for naming some rows. For instance, the consonants \textit{zh, ch, sh, r} are sometimes named „retroflexes“ (Chao 1968), sometimes „alveopalatals“ (Kratochvíl 1968), „back apicals“ (Wu 1992) or „postalveolars“ (Lin 2007).

Now I will go through all six rows of consonants and discuss their articulation, and the terms used for naming the rows. For the sake of simplification, If I use the expression „the Chinese authors“, I refer to the authors writing in Chinese, who base their analysis on \textit{pinyin}. All diagrams I will present here are of course based on the articulations of native Beijing speakers.

I will start from two rows which are least problematical:

\textbf{Row b, p, m, f}

We can skip this row, as it is generally termed as \textit{labial row} (there are three bilabial sounds and one labiodental sound). Just one remark - some authors (Kratochvíl 1968, Lin 2007) prefer to establish two separate groups: bilabial and labiodental. Transcription \textit{[p]}, \textit{[pʰ]}, \textit{[m]}, \textit{[f]} is commonly accepted.

\textbf{Row g, k, h}

This row is articulated in the velar area.

\textit{Position of the tongue}

Let us look at the diagrams of sagittal sections of three native speakers for the consonant \textit{h}. 

3
We can see the back part of the dorsum is raised. Thus this row is mostly described as **dorsal back**. However, the Chinese authors using the term *shémiàn hòu yīn* 舌面后音, „dorsal back“ are few (e.g. Cao 2002). Most often they consider this row as *shēgēn yīn* 舌根音, that is **radical** (Wu 1992, Xu 1999).

**Place of articulation**

The first two members (g, k) are definitely velar. Now the third member, h. Let us look again at the diagrams to find out where exactly this sound is articulated. We can see the place of the stricture is not the same for all speakers. Ladefoged & Wu 1984 point out that this consonant shows a considerable variability among the speakers. Furthermore, there are another factors: e.g. we can observe the influence of the following vowel: *hē* 喝 - *hào* 好. So, the answer for h is not so straightforward. Most often h is considered a **velar fricative** [x] (Wu 1992, Lee & Zee 1999, Ladefoged & Wu 1984, Lin 2007). Some authors hold that it is an **uvular fricative** [χ] (Chao 1968, Pulleyblank 1984). Duanmu 2002 even admits a possibility of **glottal fricative** [h], such as in English *hard* (where it sometimes can be a voiced [ɦ], though). However, this is not considered a standard pronunciation.

**Phonological term**

Most often g, k, h is termed a „**velar row**“*. There are some exceptions, though, which result from the phonetic analysis: Chao names the row „**guttural row**“ (adding a zero initial here as the fourth member), Pulleyblank as „**velar / uvular row**“*. The Chinese authors call it mostly *shēgēn yīn* 舌根音.

**Discussion**

For h we can count with the pronunciation [x]. Besides we can consider other allophones: uvular [χ], and possibly with some divergence from the norm also glottal [h]. (thus h: [x], [χ], [h]). In phonology, we can stick to the traditional term **velar**.
Consonants articulated
in a broader region of the upper alveolar ridge

Now let us proceed to a more difficult area. That is the upper gum ridge, upper teeth and the front part of the palate. Here the discrepancies in terminology are much more common.

In general
Many consonants are articulated in this area. We can see that in IPA, there are four categories for this region: dental, alveolar, postalveolar, retroflex. The fourth category is not motivated by the place of articulation, but by the shape of the tongue. The columns are densely occupied:

<table>
<thead>
<tr>
<th>Dental</th>
<th>Alveolar</th>
<th>Postalveolar</th>
<th>Retroflex</th>
</tr>
</thead>
<tbody>
<tr>
<td>t d</td>
<td>t d</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>r</td>
<td>r</td>
<td>r</td>
<td>r</td>
</tr>
<tr>
<td>θ ð</td>
<td>s z</td>
<td>s z</td>
<td></td>
</tr>
<tr>
<td>l ɾ</td>
<td>l ɾ</td>
<td>l</td>
<td>l</td>
</tr>
</tbody>
</table>

Fig. 2: IPA - part of the consonant table

We can see that the first three categories do not have special columns - except for the fricatives. This leaves space for some modifications which might be needed for a specific language. The fourth category - retroflex - needs a different interpretation in different languages.
Now let us look at the involvement of the tongue. For this area, the front part of the tongue comes into play. The tongue is very movable and can take different positions. We can have various articulations here, according to what part of the tongue is involved in articulation:

- anterodorsal articulation 舌面前
- laminal articulation 舌叶 lamina (= small region right behind the tip)
- apical articulation 舌尖 tip of the tongue
- sub-apical articulation 舌尖下 the underside of the tip

I did not give here a retroflex articulation (卷舌) as an independent item. That is because it is split: the markedly retroflex articulation can be identified with sub-apical articulation, the „less retroflex“ ones can be placed among apical articulations (see below).

In Mandarin

In Mandarin, there are four rows of consonants articulated in this region:

<table>
<thead>
<tr>
<th>Position</th>
<th>Chinese</th>
<th>English</th>
</tr>
</thead>
<tbody>
<tr>
<td>alveolar</td>
<td>齿龈音</td>
<td>d, t, n, l</td>
</tr>
<tr>
<td>dental</td>
<td>齿音</td>
<td>z, c, s</td>
</tr>
<tr>
<td>retroflex</td>
<td>卷舌音</td>
<td>zh, ch, sh, r</td>
</tr>
<tr>
<td>palatal</td>
<td>舌音</td>
<td>j, q, x</td>
</tr>
</tbody>
</table>

There is a disagreement in the literature - both about their phonetic description, and about the names of the rows. The authors agree, though, that the first three rows are pronounced with the tip of the tongue, that is - they are apical.

The Chinese authors usually use different labels, which are motivated by the tongue, not by the place of articulation (Wu 1992, Huang & Liao 1997).

<table>
<thead>
<tr>
<th>Chinese</th>
<th>English</th>
<th>Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>shéjiān zhōng yīn 舌尖中音</td>
<td>„apical central“</td>
<td>d, t, n, l</td>
</tr>
<tr>
<td>shéjiān qián yīn 舌尖前音</td>
<td>„apical front“</td>
<td>z, c, s</td>
</tr>
<tr>
<td>shéjiān hòu yīn 舌尖后音</td>
<td>„apical back“</td>
<td>zh, ch, sh, r</td>
</tr>
<tr>
<td>shémiàn yīn 舌面音</td>
<td>„dorsal“</td>
<td>j, q, x</td>
</tr>
</tbody>
</table>

(We can find some minor differences: e.g. sometimes the row d, t, n, l is labeled only „apical“ - Xu 1999, Cao 2002 - or the row zh, ch, sh, r is sometimes labeled 卷舌音).

Now let us examine the particular rows.

**Row d, t, n, l, row z, c, s**

**Position of the tongue**

These are sagittal cuts of s [s] as pronounced by three speakers:
Fig. 3: Tongue position for s (Ladefoged & Wu 1984, three native Beijing speakers)

The tip of the tongue is slightly raised and touches the front alveolar and/or dental region. For all three speakers we can observe a concave dipping of the tongue. Now let us check the sagittal cut for d.

Fig. 4: Tongue position for d (Zhou & Wu 1963)

We can see that the tongue position is rather similar for both consonants - i.e. for s and d. It is made with the tip of the tongue. Most authors agree upon apical articulation for both rows. I found only one exception, suggesting partly laminal articulation: it is the phonetic study of Lee & Zee 1999. For d, t, n they give apico-laminal, for z, c, s apico-laminal or laminal. Only l is apical according to them. Zhou & Wu 1963 found out that with z, c, s, the tip of the tongue is sometimes located next to the lower teeth - in that case the articulation is dorsal, NOT apical. Ladefoged & Maddieson 1994 notice that for z, c, s the body of the tongue shows slight dipping, which does not hold for d, t, n, l. Yet we can observe the dipping on the sagittal cut for d as presented at Fig. 4.

Place of articulation:

Is the place of articulation of these two rows the same? Let us look at the palatograms. They suggest there MIGHT BE a minor difference: First let us explore the row z, c, s, namely the fricative s:

Fig. 5: Palatograms of s (Ladefoged & Wu 1984, three native Beijing speakers)

We can see that the contact of the tongue with the alveoli is quite narrow (although we observe certain variability). It follows that a part of the tongue edges touches the upper teeth.
Now let us take a look at **d, t, n**:

![Fig. 6: Palatograms of d, t, n (Zhou & Wu 1963)](image)

The articulation here is slightly more backwards. It hits a larger part of the alveolar ridge, the contact area is quite broad. However, this does not have to be the rule: Look at another palatograms of **d, t** offered by another study (one speaker):

![Fig. 7: Palatograms of d, t (Ohnesorg & Švarný 1955, one speaker)](image)

The contact area is obviously not as broad here. We can conclude there is a considerable variability of pronunciation with different speakers.

What **localization** of the row **d, t, n, l** and the row **z, c, s** do we find in the literature?

- Some authors assume the place of articulation of both rows is **the same**. However, they specify the place differently:
  - **alveolar**, i.e. the front part of the alveolar ridge: Ladefoged & Wu 1984, Pulleyblank 1984, Li 1999
  - **denti-alveolar**: Lee & Zee 1999

- Some authors give two **different places**. Most of them think that the row **z, c, s** is more front. Hsüeh assumes that **d, t, n, l** is more front.
There is agreement in the literature abut the following transcription:
\[
[t], [t^h], [n], [l] \quad [ts], [ts^h], [s]
\]

Phonological terms

What are the names for these two rows used in the literature? It follows the phonetic analysis:
- both rows are assigned the same place: „dentals“ (Lin 2007), „dentals“ d, t, n, l, „dental sibilants“ z, c, s (Chao 1968), „alveolars“ (Pulleyblank 1984, Li 1999)
- each row has a different label - e.g. „alveolars“ d, t, n, l, „dentals“ z, c, s (e.g. Kratochvíl 1968). The Chinese authors mostly use the terms shéjiān zhōng yīn 舌尖中音 („apical central“) for d, t, n, l, shéjiān qián yīn 舌尖前音 („apical front“) for z, c, s, as we already stated above.

Here is a small survey of the differences in labeling terms for d, t, n, l and z, c, s:

<table>
<thead>
<tr>
<th></th>
<th>d, t, n, l</th>
<th>z, c, s</th>
</tr>
</thead>
<tbody>
<tr>
<td>dentals</td>
<td>dents</td>
<td>denti-</td>
</tr>
<tr>
<td>alveolar</td>
<td>alveolars</td>
<td>alveolar</td>
</tr>
<tr>
<td>prealveol.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>apic. cent.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>authors</th>
<th>Chao</th>
<th>Lee &amp; Zee</th>
<th>Pulleyblank</th>
<th>Kratochvíl</th>
<th>Hsüeh</th>
<th>Wu</th>
</tr>
</thead>
<tbody>
<tr>
<td>d, t, n, l</td>
<td>dentals</td>
<td>dents</td>
<td>alveolar</td>
<td>prealveolar</td>
<td>apic. cent.</td>
<td></td>
</tr>
<tr>
<td>z, c, s</td>
<td></td>
<td>alveolar</td>
<td></td>
<td></td>
<td>apic. front</td>
<td></td>
</tr>
</tbody>
</table>

Now - which solution is the best? How to label these two rows?
My opinion is that the difference in the place of articulation between z, c, s and d, t, n, l, if it exists at all, is very subtle. And even if minor differences existed, there is no point in reflecting them in the classificatory terms. I suggest to label both rows as denti-alveolar (as Lee & Zee 1999 do).

Now: if we term both rows as dentialveolar and apical (or apico-laminal), what is the difference between them? It is of course the manner of articulation:
- The row d, t, n, l has two stops, one nasal and one lateral.
- The row z, c, s has two affricates and one fricative.

Last remark: the term dentialveolar is usually paired with the laminal, not apical articulation of the tongue; but Lee Zee assume it is slightly laminal: apico-laminal.
Row zh, ch, sh, r

This row is traditionally called the **retroflex row** (in Chinese *juǎnshé yín* 卷舌音). This seems to suggest the tongue should be bent backwards. We shall check whether it is true. But first, let us look at the place of articulation.

**Place of articulation**

These are palatograms of the fricative *sh*.

![Palatograms of sh](image)

**Fig 8:** Palatograms of *sh* (Ladefoged & Wu 1984, three native Peking speakers)

We can see the tongue is not in contact with the front teeth (this is clear at least for the speakers A and B). That means the place of articulation is more back than for the rows *z, c, s* and *d, t, n, l*. The tip of the tongue is thus free and could be possibly bent backwards. Obviously, the distance between the teeth and the tongue can vary among the speakers (typically it is larger with the Beijing speakers). Also, the width of the stricture can vary.

Different authors locate these sounds differently:
- **postalveolar** - (Lee & Zee 1999, Lin 2007)
- **alveo(lo-)palatal** - i.e. slightly more back (Kratochvíl 1968)
- **prepalatal** (Ohnesorg & Švarný 1955)

The Chinese authors mostly give *qián yìng’è* 前硬腭, i.e. **prepalatal** (Wu 1992, Xu 1999, Cao 2002).

**Position of the tongue**

Most authors agree that this row is also pronounced with the tip of the tongue (as the previous two are). So in this sense the articulation is **apical**. However, the **overall shape of the tongue** is different from the previous two rows. Let us look at the sagittal cuts for *sh* [ʂ]:

![Sagittal cuts for sh](image)

**Fig. 9:** Tongue position for *sh* (Ladefoged & Wu 1984, three native Peking speakers)
We can see the tip of the tongue is raised against the post-alveolar region. The concave dipping may or may not be present. The tongue is slightly retracted. Although the three speakers are slightly different, in any case it is clear the tongue is not bent backwards. It was proved by the instrumental studies a long time ago (i.e. Ohnesorg & Švarný 1955). The articulation is made with the surface of the tip (or, as Lee & Zee or Ladefoged & Maddieson 1994 assume, even laminaly) - but definitely NOT with the underside of the tip! In spite of a considerable variability of pronunciation, no Chinese speaker articulates these sounds subapically (as Lee & Zee 1999 state). That is why the phoneticians mostly avoid the term retroflex completely, or at most speak of „so called retroflexes“ (e.g. Ladefoged & Wu 1984; of course they stress the adequate interpretation of the term).

Now, it might be useful to explore the retroflex consonants in other languages. Let us take a look at two languages of India: Hindi (Indo-Aryan language) and Tamil (Dravidian language). The retroflex consonants in Indian languages are traditionally called cerebrals. The term is not homogenous, though, as the degree of retroflexion can be different in different languages (Švarný & Zvelebil 1955). We shall compare the retroflex postalveolar stop of Hindi and Tamil.

Fig. 10: Hindi [ɖ] Tamil [ɖ] (Ladefoged & Maddieson 1994:27)

- in Hindi, the tongue is raised against the post-alveolar region, but it is not is not curled backwards. The articulation is made with the edge of the tip
- in Tamil, the tongue is also raised against the postalveolar region, but the articulation is made with the underside of the tongue tip - it is sub-apical.

Now, how is this possible all these different sounds (such as in Mandarin, Hindi, Tamil) are called „retroflex“? The term retroflex is somewhat vague. It is used for a rather broad group of articulations in the postalveolar region made with the tip of the tongue. The tip is lifted, and it can be more or less curled up and backwards. So the term is used both for markedly retroflex articulations, such as in Tamil, as well as for the „less retroflex“ sounds such as in Hindi, and even for yet less „retroflex“ sounds such as in Mandarin. That means the term „retroflex“ must be interpreted differently for different languages.

Transcription
IPA has only one set of retroflex symbols - those with a tail: [ɖ], [ʂ], [ʐ] etc. So - how to express the difference between „more“ and „less“ retroflex sounds in various languages? Ladefoged and Maddieson have this solution: for the „less retroflex“ sounds (which are not sub-apical) they suggest the alveolar symbols with a dot, e.g. [ʈ, ɖ, ɳ]. In this way various degrees of retroflexion can be captured. But this is not a common practice and it was not accepted by IPA. We can run into a „dotted“ transcription of Mandarin retroflexes quite seldom.
For the Mandarin consonants zh, ch, sh, r there are the following solutions:


- Other, less frequent transcriptions, employ the alveolar symbols with a dot: [ʂ], [ʐ], as suggested by Ladefoged & Maddieson 1996. Long before them other people used this notation: Hartmann 1944, or Howie 1976: [tʂ], [tʂʰ], [ʂ], [ʐ]. Cheng 1974 writes [c], [cʰ], [ʂ], [ʐ]. Lee & Zee 1999 have a different solution, which stays within IPA conventions: as they see these sounds as apical postalveolars, they use a symbol for postalveolar fricative [ʃ] and add a special diacritic („staple”) to show the articulation is apical (not laminal or dorsal): they write [tʃʰ], [tʃʰ], [ʃ], [ʂ].

- Dragunov & Dragunova 1955 do not express the special position of the tongue at all - they have [dʐ], [tʃʰ], [ʂ], [r] (perhaps because there exist retroflex sounds [ʂ], [ʐ] in Russian).

**Note:** Consonant r is mostly treated as a voiced counterpart of the fricative sh (thus [ʂ] - [ʐ]) However, many authors prefer to view it as an approximant (Pulleyblank 1984, Lee & Zee 1999, Duanmu 2002). It is transcribed either as a retroflex approximant [ɻ], or, less frequently, as a postalveolar approximant [ɻ]. Lately there is an opinion that [ʐ], [ɻ] are free variants of the phoneme /ɻ/ (we can observe a considerable variability of pronunciation).

**Phonological term**

The absolute majority of authors labels this row as a „retroflex row“ (Chao 1968, Wang 1963, Howie 1976, Pulleyblank 1984, Hsüeh 1986, Norman 1988, Duanmu 2002). Some of them point out that the real articulation is not really retroflex, but some don’t. Lin 2007 is an exception - she prefers to avoid the term „retroflex row“. She labels these sounds as „postalveolar row“ (and stresses the articulation is not retroflex).

The Chinese authors mostly use the term shéjiān hòu yīn 舌尖后音 („apical back“). Sometimes we can see qiáoshé yīn 翘舌音, i.e. „cacuminal“ (lat. cacumen = „the tip“). The term juānshé yīn 卷舌音 i.e. „retroflex“ is seldom used.

**Discussion**

We can wonder whether it is appropriate to label zh, ch, sh, r as a „retroflex row“ in a phonological description? As we showed above, a general term can have different interpretations in different languages. So it is for Mandarin. The term „retroflex“, does not necessarily imply that the tongue is bent backwards. We do not have to be so strict in a phonological description - the main issue is the contrast. As Ladefoged & Maddieson 1996 point out, no language is known which contrasts apical and sub-apical retroflexes. For this reason, I think we can keep this traditional term „retroflexes“ (eventhough there is an alternative - to call the row „postalveolars“, as Lin 2007 does).

A phonetic description is a different matter. We have to interpret the term „retroflex“ correctly. The main point that has to be made is, that the articulation is apical, not sub-apical. In the phonetic description, I recommend to avoid the term „retroflex“ at all. It is better to speak about postalveolar apical sounds.

In transcription we can stick to the tradition and use the retroflex IPA symbols, i.e. [tʂ], [tʂʰ], [ʂ], [ʐ]. I believe that the more exact transcription, such as with the „stapled“ or
"dotted" symbols, is not necessary. (Ladefoged and Maddieson felt a need for a fine
differentiation, as they were comparing various languages of the world, whereas we are
describing just Mandarin). Yet, these symbols must be given a proper interpretation.

Row j, q, x

This row is traditionally called a "palatal row". This seems to suggest the dorsum of the
tongue is raised straight up against the palate. Let us see whether it is so.

**Place of articulation**
Which part of the palate comes into play? Let us look at the palatograms:

![Palatograms](Zhou & Wu 1963)

We can see the imprint of the tongue is rather narrow, that means the body of the tongue is
obviously not lifted straight up, but presses to somewhat more front region. The roof of the
mouth is not affected here. We can say the articulation is about **alveolo-palatal**.

However, this does not have to be the truth with every speaker.
Look at another palatograms:

![Palatograms](Ohnesorg & Švarný 1955)

Obviously, the contact of the tongue with the palate is much larger here. In case of q, x we
can even observe a distance between the tongue and the front teeth. So in this case we can
speak of **palatal articulation**. Again, these consonants can be pronounced in different ways by different speakers. Here is another proof of the variability among the speakers. These are three speakers pronouncing the fricative **x**:

![Palatograms](image_url)

**Fig. 13:** Palatograms of **x** (Ladefoged & Wu 1984, three native Beijing speakers)

So after all: are these sounds true palatals, or do they articulate more front? I did not find any phonetic description which speaks of a purely palatal articulation. Most often the articulation is described as **alveolo-palatal**. Ladefoged & Maddieson 1996 call them **alveolo-palatal**s, or alternatively **palatalized post-alveolars** (they explicitly say they avoid the term palatal, which has to be reserved for the sounds articulated more back). Also Ladefoged & Wu 1984 and Lin 2007 regard them as **alveolo-palatals**. Ohnesorg & Švarný 1955 consider them as **palatalized postalveolars**. Lee & Zee 1999 are very detailed: **j, q = alveolo-palatal, x = postalveolar or prepalatal** (note that retroflexes are postalveolar for him).

The Chinese authors slightly differ - they locate the articulation at **qián yìng´è** 前硬腭, i.e. front palate, i.e. **prepalatal** (Zhou & Wu 1963, Wu 1992, Huang & Liao 1997, Xu 1999).

**Position of the tongue**

Let us look at the sagittal cut for the affricate **j**:

![Tongue position](image_url)

**Fig. 14:** Tongue position for **j** [dz] (Ladefoged & Wu 1984, there native Beijing speakers)

The body of the tongue is convexely bulged against the front part of the mouth roof and the back of the alveolar ridge. The convex shape is especially obvious with the third speaker. The tip of the tongue is lowered and rests behind the lower teeth. So, we can see the tongue position is quite different from that of retroflexes. That is why the beginners have troubles pronouncing the words like **xiānshèng, zhūqiú, qǐchē, zìxíngchē** etc.

Now which **part of the tongue** is involved in the articulation? It is not the whole dorsum, but the front part of it. Thus, most often we meet **(antero)dorsal** specification (Ohnesorg & Švarný 1955, Hsüeh 1986). Very detailed are again Lee & Zee 1999. For **x** they give **laminooanterodorsal**, while **j, q** can be either **laminooanterodorsal** or **apico(!)-anterodorsal**.

Chinese authors also give **shémiàn qiánbù** 舌面前部 (Zhou & Wu 1963, Wu 1992, Xu 1999,

**Transcription**
Commonly accepted transcription is this: j [t̚], q [t̚ʰ], x [ɕ]. We can see a symbol for the alveolo-palatal fricative [ɕ] is employed. Very seldom we can see the use of the symbol for the palatal fricative [ç] (Duanmu 2002). He writes j [t̚], q [t̚ʰ], x [ɕ]. This is not correct - it does not agree with the real place of articulation. The sound [ɕ] represents German ich-Laut which is really palatal - and which sounds quite different.

**Phonological Term**
- Most authors prefer a traditional term „palatal row“ - such as Chao 1968, Kratochvíl 1968, Pulleyblank 1984 etc. Some of them point out that the articulation is not purely palatal (Norman 1988, Lee & Zee 1999). If someone uses the term „alveolo-palatal“ (Ladefoged & Maddieson 1996:149, Ladefoged & Wu 1984), or „postalveolar palatalized“ (Ohnesorg & Švarný 1955), it is a phonetician, not phonologist.

**Discussion**
The term „palatal row“, as we saw, does not reflect the place of articulation in detail. It can be even misleading - especially in the language teaching, as I found out with myself and my students. Unless they are instructed well, they attempt to pronounce these sounds as pure palatals, e.g. they pronounce x as [ɕ].
So would it be better to rename the row and call it „alveolo-palatal“ instead? I do not think so. As I pointed out already, it is not necessary to capture the phonetic detail while labeling the sounds phonologically. There is no contrast between palatal and alveopalatal sounds in Mandarin.

**CONCLUSIONS**
We discovered that some classificatory terms for the rows of Mandarin consonants do not correspond in detail with the articulation. My conclusions follow:

1. In phonology, that is in classification, I suggest to stick to the traditional terms „palatal row“ and „retroflex row“, eventhough they are not phonetically accurate. They are quite sufficient as the labels. They have been commonly accepted in the literature for many years, they are short and easy to rememebor/pronounce. Introducing a new term (e.g. „postalveolar row“ for zh, ch, sh, r) might have more disadvantages than advantages. There is no need to be overly meticulous when choosing the classifying terms.

2. We must not expect the phonetic „exactness“ from these terms. Most often they pick up only one single feature (usually it is the place of articulation - sometimes only approximate) and neglect other features. However, as Ladefoged & Wu 1984 point out in their study of
Mandarin fricatives and affricates, the whole shape of the vocal tract is important. For some sounds the location of the stricture even does not have to be particularly critical. For instance, the difference between the place of articulation of zh, ch, sh, r and j, q, x is very subtle. The major difference is in the position of the tongue (Ladefoged & Maddieson 1994). The teeth position also can be very important - the closeness of upper and lower teeth can create a secondary source of friction, such as for s, sh, x. It follows the informative value of the classificatory terms must not be overrated.

(3) Because the labeling terms are nor exact, nor comprehensive, they need a correct and sufficiently detailed phonetic interpretation, giving all relevant phonetic details. At the same time, the phonetic description should avoid being too narrow and dogmatic. It should leave some tolerance and count with a certain variability among the speakers (even for one speaker).

(4): We should always make clear when a particular term is used for phonetic description, and when it is used as a term of classification. Otherwise we risk confusion, e.g. in language teaching.

(5) The rows d, t, n, l and z, c, s are sometimes (though not always) labeled as if they are articulated at slightly different places (alveolar x dental). Even if it was true, this level of detailness in phonology is inconsistent with a more generous approach applied to the rows „palatal“ and „retroflex“. Furtermore, it is even doubtful whether the places of articulation are really different. Possibly these two rows are labeled differently for convenience - it is more practical to have two distinct labels for them. Nevertheless, I assume, together with Lee Zee 1999, these two rows have the same basic place of articulation - i.e. denti-alveolar. Consequently, in phonological classification I suggest to label all these consonants as „denti-alveolars“. The two denti-alveolar rows are sufficiently differentiated by the manner of articulation - z, c, s can be termed „denti-alveolar sibilants“, while d, t, n, l simply as „denti-alveolars“ or (if we wish to be more explicit) „denti-alveolar non-sibilants“.

(6) I tried to map out various solutions and analyses. I found out that there is no cannonical analysis for the initial consonants - both in phonetic description (including transcription) and in phonological classification. Literally every row has one or more alternative labels in the literature. I arrived at the following version of classification (the articulatory phonetic features are based on Lee and Zee, eventhough are somewhat less detailed here):

<table>
<thead>
<tr>
<th>label</th>
<th>place of articulation</th>
<th>tongue</th>
</tr>
</thead>
<tbody>
<tr>
<td>b, p, f, m</td>
<td>labials</td>
<td>bilabial, labiodental (f)</td>
</tr>
<tr>
<td>d, t, n, l</td>
<td>denti-alveolars</td>
<td>denti-alveolar</td>
</tr>
<tr>
<td>z, c, s</td>
<td>denti-alveolar sibilants</td>
<td>denti-alveolar</td>
</tr>
<tr>
<td>zh, ch, sh, r</td>
<td>retroflexes</td>
<td>postalveolar</td>
</tr>
<tr>
<td>j, q, x</td>
<td>palatals</td>
<td>alveolo-palatal</td>
</tr>
<tr>
<td>g, k, h</td>
<td>velars</td>
<td>velar, uvular (h)</td>
</tr>
</tbody>
</table>

Fig. 15: A table of Mandarin initial consonants
Appendix:

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

<table>
<thead>
<tr>
<th>Consonants (Pulmonic)</th>
<th>Bilabial</th>
<th>Labiodental</th>
<th>Dental</th>
<th>Alveolar</th>
<th>Post-alveolar</th>
<th>Retroflex</th>
<th>Palatal</th>
<th>Velar</th>
<th>Uvular</th>
<th>Pharyngeal</th>
<th>Glottal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plosive</td>
<td>p b</td>
<td>t d</td>
<td>t d</td>
<td>c j</td>
<td>k g</td>
<td>q g</td>
<td>?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nasal</td>
<td>m n</td>
<td>n n</td>
<td>n j</td>
<td>n j</td>
<td>N</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Trill</td>
<td>B R</td>
<td>R R</td>
<td></td>
<td>R R</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tap or Flap</td>
<td>v v</td>
<td>v r</td>
<td>v t</td>
<td>v t</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fricative</td>
<td>φ β f v</td>
<td>θ δ s z</td>
<td>j ʃ z</td>
<td>c j x y</td>
<td>χ r h</td>
<td>f h n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral fricative</td>
<td></td>
<td>l h</td>
<td>l h</td>
<td>l h</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Approximant</td>
<td>u j</td>
<td>l j</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral approximant</td>
<td>l l</td>
<td>l j l</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

Literature


