

The palatal element hides in (some) non-palatals: the case of Mandarin Chinese

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This paper deals with restrictions holding between onsets and rimes in Mandarin Chinese words. Based on general principles of the theory of Government Phonology it proposes a new melodic structure of the Chinese onset segmental inventory and provides an explanation for traditional systematic gaps in the distribution of i-rimes. The proposal follows the idea that *i* is never lexically present in the vocalic part of the syllable, but always originates in the preceding consonant (as an operator I). While I operator is responsible for the i-glide in i-rimes, I head prohibits its occurrence.

1. Introduction

In this paper I will argue against the previously established analyses of the melodic structure of (Mandarin) Chinese consonants. In particular, based on the distributional facts of i-rimes I will propose that velar and retroflex consonants contain the element that is usually phonetically associated with palatality. In this way some aspects of Chinese phonotactics will fall out of the proposed analysis. In §2 the traditional structure of the Chinese word will be presented, followed by the new analysis in §3. In §3.1 two basic principles the analysis relies on will be discussed, then a closer look will be taken at i-rimes (§3.2), which will be followed by a criticism of one of the previous analyses within the same theoretical framework (§3.3). §3.4 will provide a new view at the structure of Chinese onsets and its consequences for the distributional facts of i-rimes. In §3.5 a brief look will be taken at rimes different from i-rimes and some problematic cases will be pointed out.

The proposal will be couched within Government Phonology framework (Kaye et al. 1985; 1990).

2. Traditional structure of the Chinese word

There are severe phonotactic restrictions holding within the Chinese phonological word. A Chinese word in most cases consists of one syllable with strictly limited structure.

Following Ramsey (1987) the Chinese word is traditionally divided into an initial (the initial consonant) and a final (the rest of the syllable), which I will refer to as rime in the remainder of the paper. The rime consists of at least one element (the main vowel) or at most three elements (the medial, the main vowel and the ending).¹ While there are (traditionally) 21 candidates for the initial, the rest of the components are more limited as to what segments they can host. Thus, in the medial only *i*, *u*, *ü* can be found, the main vowel can either be *a*, *e*, *i*, *u*, *ü*² and the ending can host either *i*, *u*, *n*, *ng*, *r*.³ For instance in a word like *huang*,⁴ *h* is the initial, while *uang* is the

¹The traditional categorisation loses a little of its credit, when one reads that the medials in traditional Chinese poetry did not matter in rhyming while the main vowel and the ending did (see Li 1998). If they all belonged to the same syllabic constituent they would be expected to behave as a unit.

²Interestingly, Ramsey (1987:44) considers all rimes beginning with *i*, including rimes like *-ing* as in *ling* (except the open ending i-rime as in *li*) as containing a medial, not the main vowel *i*.

³Throughout the paper the official Chinese romanization system (pinyin) is used. Phonetic value (in IPA symbols) of the analysed segments can be found in table 1.

⁴The examples will not be glossed since their only function is to represent grammatical Chinese syllables in terms of phonotactics. If we

final that consists of the medial *u*, the main vowel *a* and the ending *ng*.

It is widely attested that languages allow for more contrasts in onsets of syllables than in codas (Blevins 1995:227), so the above constraints do not make Chinese special in any major way.⁵ However, if we take a closer look at distributional facts of the above-stated permissible segments in each of the syllabic positions, we will immediately get struck by the fact that even these segments are not in free distribution and that table 1 displays some systematic gaps.⁶ What is more, we will see that there seems to be an interdependency of syllabic positions imposing further constraints on the overall structure of the syllable. This has led phonologists to propose some sort of a templatic nature of a Chinese word (cf. Goh 1996, Kaye 2001b). A Chinese template consists of precisely four positions: two pairs of a consonantal position followed by a vocalic one. Each position is restricted to what sort of melodic material it can host and whether or not it can remain empty.

In this paper we will focus on gaps in the distribution of rimes beginning with *i*, henceforth called *i*-rimes. The rimes beginning with *u*, though indispensable for getting the whole picture of Chinese phonological system, will be left aside for further research. We will not so much be interested in a few scattered, most likely historical gaps in the distribution of *i*-rimes (like with an initial *f*); what we will focus our attention on are systematic gaps occurring with all the members of a natural class. Let us take a look at these.

Table 1 reveals a large gap in *i*-rimes with two big groups of initial segments: non-palatal affricates/fricatives and velars. However, another big group of segments, palatal affricates/fricatives, occur in exactly the opposite environment, namely, exclusively before *i*-rimes.

Naturally, what we are interested in is the question *why* the distribution is as it is. If the two traditionally recognized parts of the Chinese syllable (the initial and the rime) acted as independently from each other as the tradition suggests, these restrictions would not be expected to occur. Is there more to the Chinese syllable than meets the eye? What is it and how does it constrain the form of a syllable? Let us take a look at what a phonological theory can tell us about it.

3. The analysis

3.1. Basic principles

The phonotactic restrictions of *i*-rimes and the 21 Chinese initials will be given within Government Phonology (GP) framework. The analysis will crucially rely on some basic principles of the theory.

The first one is called Free Distribution Principle (FDP). It states that “any onset should occur with any nucleus unless excluded by some explicit constraint” (Kaye 2001b:4). According to this principle we would expect no restrictions in occurrence of initials and rimes in Chinese syllables unless constraints can be found as inhibitors of the occurrence. The principle itself does not say anything explicit about the nature of such a constraint, however, it is expected that these constraints are as general as possible and following from the general theoretical principles. What we want to avoid if the Free Distribution Principle is to keep any credit is a language-specific, descriptive or non-explanatory nature of constraints. Needless to say, a constraint stating that “in Chinese palatal consonants cannot be followed by anything else but an *i*-rime” will not be satisfactory for the explanatory reasons but can function as a pretheoretical observational starting-point.

The second principle the analysis will rely on is Kaye’s Phonological Epistemological Principle (PEP) which states that “the only source of phonological knowledge is phonological behaviour” (Kaye 2001b:1). This means that phonetic cues are of secondary importance and should as such give way to conclusions based on phonological behaviour of segments in question. In practice, this means that even though in GP the building blocks of melody, i.e. elements, have been assigned some rough correlates in phonetics, like palatality or velarity, we will not rely on these but priority will be given to the phonological behaviour of the elements, for instance, combinatorial possibilities of elements in the melodic makeup of a segment, their status within a melodic expression etc.

wanted to gloss them, we would have to assign each of them a tonal pattern. Tone, however, is beyond the scope of this paper.

⁵In this analysis I will generally refer to initial consonants and the following vowels as onsets and nuclei, respectively. To refer to the traditional view on Chinese phonological system, it seems inevitable to use the terms like initials and rimes. These, however, are different from the above-mentioned onsets and rimes as is made clear in the paper.

⁶The table is taken from Ramsey (1987), supplemented by data from Goh (1996), which appear in parenthesis. The same data will be used later in table 3.

	i	ia	ie	iao	iou	ian	in	iang	ing	e	ei	a	ai	ao	ou	an	en	ang	eng
	[i]	[ia]	[ie]	[iao]	[iou]	[iɛn]	[in]	[iaŋ]	[iŋ]	[ɛ]	[ɛi]	[a]	[ai]	[au]	[ou]	[an]	[ɛn]	[aŋ]	[ɛŋ]
b [p]	bi	(bia)	bie	biao		bian	bin	(biang)	bing		bei	ba	bai	bao		ban	ben	bang	beng
p [p ^h]	pi	(pia)	pie	piao		pian	pin	(piang)	ping		pei	pa	pai	pao	pou	pan	pen	pang	peng
m [m]	mi		mie	miao	miu	mian	min		ming		mei	ma	mai	mao	mou	man	men	mang	meng
f [f]											fei	fa			fou	fen	fen	fang	feng
d [t]	di	dia	die	diao	diu	dian	(din)	(diang)	ding	de	dei	da	dai	dao	dou	dan	den	dang	deng
t [t ^h]	ti		tie	tiao		tian	(tin)	(tiang)	ting	te	tei	ta	tai	tao	tou	tan		tang	teng
n [n]	ni		nie	niao	niu	nian	nin	niang	ning	ne	nei	na	nai	nao	nou	nan	nen	nang	neng
l [l]	li	lia	lie	liao	liu	lian	lin	liang	ling	le	lei	la	lai	lao	lou	lan		lang	leng
z [ts]										ze	zei	za	zai	zao	zou	zan	zen	zang	zeng
c [ts ^h]										ce	cei	ca	cai	cao	cou	can	cen	cang	ceng
s [s]										se	(sei)	sa	sai	sao	sou	san	sen	sang	seng
zh [ʈʂ]										zhe	zhei	zha	zhai	zhao	zhou	zhan	zhen	zhang	zheng
ch [ʈʂ ^h]										che	chē	cha	chai	chao	chou	chan	chen	chang	cheng
sh [ʂ]										she	shē	sha	shai	shao	shou	shan	shen	shang	sheng
r [ʐ]										re				rao	rou	ran	ren	rang	reng
j [tɕ]	ji	jia	jie	jiao	jiu	jian	jin	jiang	jing										
q [tɕ ^h]	qi	qia	qie	qiao	qiu	qian	qin	qiang	qing										
x [ç]	xi	xia	xie	xiao	xiu	xian	xin	xiang	xing										
g [k]										ge	gei	ga	gai	gao	gou	gan	gen	gang	geng
k [k ^h]										ke	kei	ka	kai	kao	kou	kan	ken	kang	keng
h [x]										he	hei	ha	hai	hao	hou	han	hen	hang	heng
	yi	ya	ye	yao	you	yan	yin	yang	ying	e	ei	a	ai	ao	ou	an	en	ang	eng

Table 1: Traditional structure of the Chinese word: combining initials and rimes

3.2. The shape of i-rimes: are they lexical?

Taking a closer, yet pre-theoretical look at i-rimes it can be easily noticed that apart from their i-part most of them closely resemble rimes without medials (compare [iaŋ] with [aŋ], [iau] with [au] and other pairs).⁷ Considering these similarities between the two sets of rimes, we expect that they are not two different lexical sets but one can be derived from the other. Due to existence of u-rimes beside i-rimes that exhibit similar facts, we assume that rimes without medials are the ones that all other types are derived from, for a simple reason that they only involve addition of components and not deletion and addition as would be the case if we wanted to derive, say, u-rimes from i-rimes.

The question now arises how to derive i-rimes from rimes without medial. In GP melodic material cannot appear out of nowhere but needs to be present locally at all stages of derivation. So, if we take a random candidate out of our 21 Chinese initial group, say, *n* and combine it with rime *ao* we end up with a Chinese syllable *nao*. How do we ever get *niao* as our result? Furthermore, we can observe that not all of the 21 initials can be followed by an i-rime. This is highly suggestive of a proposal that the nature of the onset will determine what rimes can follow it.

3.3. On Kaye's analysis

Let us first take a look at an analysis which is also couched within GP framework and strongly relies on Free Distribution Principle.

Kaye (2001b) (following Goh (1996)) treats i-rimes slightly differently from what will be the proposal of this paper: it does not abandon them altogether. Due to the existence of i-rimes with some non-palatal onsets *d, t, b, p, m* (assuming that the palatal element is the source of *i*) Kaye concludes that some i-rimes are lexical, while others can be derived. However, some on the surface identical rimes, as i.e. in *xie* and *bie*, can either be derived or lexical: in *xie* the i-glide can be contributed to the rime from the palatal onset, on the other hand, *bie* does not have a palatal onset, therefore the i-glide has to appear as a lexical part of the vowel. He also finds cases where due to the existence of both a palatal and a non-palatal form of a consonant (*n, l*) the source of the i-glide in the rime cannot be determined.

Following from FDP and his assumption of the existence of lexical i-rimes is that all onsets will be followed by these rimes. Table 1 reveals that this is not the case with velar and retroflex onsets, therefore other stipulations are needed to account for this absence. For example, rime -i can occur after U-headed and A-headed onsets only (Kaye 2001b:12). This excludes velars, which are headless, and retroflex segments, which are I-headed. Although this looks as a constraint FDP allows for, it is in my view too language specific and as such non-explanatory. Having no universal value it cannot be given more credit than a mere observation.

In this paper we will try to do away with different sources of the same surface rimes by proposing that the only lexical vowel is *a*. This implies that no i-rime is ever lexical and the glide is always a part of the onset. This view has been proposed in Neubarth & Rennison (2002). Moreover, I will try to abandon Kaye's observational constraints and propose such onset segmental inventory that FDP will (without any constraints) generate precisely the existing set of Chinese syllables.

3.4. I in onsets

Having abandoned i-rimes as lexical constructs from the Chinese phonological system we are left with an onset as the only source of *i*. Let us explore this possibility.

Since we want the onsets in Chinese to be the source of the traditional medials it is crucial to give up a belief in precisely 21 initial candidates. Thus the examples from above, *nao* and *niao*, crucially involve two different onsets *n* and *nⁱ*, as has already been proposed by Kaye (2001b). This means that the onset position in Chinese allows for

⁷This statement might seem too strong, since there are several rimes without medial that do not have correlates in i-rimes and also some i-rimes displaying different shapes from rimes without medial. Neubarth & Rennison (2002) propose that these rimes are underlyingly the same but their different surface realisation is the result of independent phonological processes. The analysis of these is beyond the scope of this paper.

even more contrasts and thus increases the number of lexical segments that has been proposed by traditional view. Since the onset position has been the position of most contrasts this should not seem problematic in any way.

In this paper I will adopt Kaye's [2001b] proposal that onsets followed by a non-lexical i-rime contain element I as an operator in their melodic makeup, but doing so with a slight change, namely, that onsets followed by i-rime in general (since no i-rime is lexical) contain I operator.

Adopting the view that the i-rime set of onsets is derived from basic onsets by means of addition of operator I conforms to the assumption that a more complex segment implies the existence of a less complex one (cf. Moren 2007). As a consequence we expect that each onset with an operator I will have its counterpart without an operator I.

It can be quickly noticed that not all initials can take i-rimes. According to the above theory this means that certain onsets cannot contain operator I in their melodic makeup. In what follows I will try to explain why precisely these initials cannot take i-rimes while others can.

GP assumes that two elements of the same kind cannot co-occur in the same melodic expression regardless of their status (head or operator) (Kaye (2001a), also cf. Neubarth & Rennison (2002:4)). The consequence of this assumption in our case is that onsets which contain I as a head will not be able to take another I as an operator or the other way around. In other words, the consonants with I head will never have palatal counterparts, while consonants without I will always have them. Bearing this in mind leaves us to determine the makeup of consonants in Chinese regarding element I.

The three logical possibilities of occurrence of I in a consonant are the following: (i) I is a head, (ii) I is an operator, (iii) I is absent. According to the general assumption just stated above, consonants belonging to (i) will have no variant with I operator. In effect this means no palatal counterpart, which means in traditional view no i-rime. Group (iii) on the other hand will occur with rimes without medials, but will not be prohibited from having a counterpart with a I operator. Group (ii) thus consists of palatal counterparts of (iii).

Well equipped with these theoretical assumptions it is time to determine the makeup of actual Chinese consonants and account for distributional facts from table 1, which shows that most of the consonants can appear with rimes without a medial. The only striking systematic gap appears with palatals *j, q, x*. This is most easily explained if we assume that these segments are the palatal counterparts of some other set that lacks i-rimes. How do we recognize this set?

Its characteristic is that these consonants do not appear with i-rimes. Table 1 displays that the following consonants cannot take i-rimes: *z, c, s, zh, ch, sh, r, g, k, h*. We will assume that there should be a minimal change in the melodic makeup of the palatal and non-palatal series (in terms of I). Since *j, q* are affricates and *x* is a fricative it is expected that the non-palatal variants are such as well. This leaves us with *zh, ch, sh* or *z, c, s* as possible candidates.

Recall that there are two theoretical reasons not to appear with i-rimes with regard to the melodic makeup of a segment: (i) I is absent, or (ii) I already appears as a head. The set we are looking for will have the former shape.

The data from Taiwanese provide the final piece of the puzzle. According to Neubarth & Rennison (2002), in Taiwanese palatals *j, q, x* and non-palatals *z, c, s, zh, ch, sh* fall into the coronal series *z, c, s*. This process can be viewed as neutralisation, which is in GP generally considered as loss of melodic material. For this reason we can conclude that *z, c, s* in Taiwanese are the least complex in terms of segmental makeup, this means without I altogether.

Based on the evidence from Taiwanese we thus conclude that *j, q, x* is the series with an I operator and as such the palatal counterpart of the series without I (*z, c, s*). The series without palatal counterparts is I-headed (*zh, ch, sh*). As such these onsets never appear with i-rimes.

The velars *g, k, h* and *r* show identical phonological behaviour as the retroflex series in a very crucial respect: they never appear with i-rimes. In addition, there are no candidates among the onsets that do take i-rimes that have not been assigned non-palatal counterparts yet. Since there seem to be no palatal variants of *g, k, h, r*, we must conclude that these consonants also contain I as a head in their melodic makeup, which consequently prevents them from having I-operator counterparts.

head I	ch	zh	sh	-	-	-	-	k	g	r	ng	h
operator I	q	j	x	p ^j	b ^j	m ^j	(f ^j)	t ^j	d ^j	l ^j	n ^j	y
I absent	c	z	s	p	b	m	f	t	d	l	n	

Table 2: Chinese onset segmental inventory

	e	ei	a	ai	ao	ou	an	en	ang	eng
b		bei	ba	bai	bao		ban	ben	bang	beng
p		pei	pa	pai	pao	pou	pan	pen	pang	peng
m		mei	ma	mai	mao	mou	man	men	mang	meng
f		fei	fa			fou	fan	fen	fang	feng
d	de	dei	da	dai	dao	dou	dan	den	dang	deng
t	te	tei	ta	tai	tao	tou	tan		tang	teng
n	ne	nei	na	nai	nao	nou	nan	nen	nang	neng
l	le	lei	la	lai	lao	lou	lan		lang	leng
z	ze	zei	za	zai	zao	zou	zan	zen	zang	zeng
c	ce	cei	ca	cai	cao	cou	can	cen	cang	ceng
s	se	(sei)	sa	sai	sao	sou	san	sen	sang	seng
	e	ei	a	ai	ao	ou	an	en	ang	eng
b ^j		bi	(bia)	bie	biao		bian	bin	(biang)	bing
p ^j		pi	(pia)	pie	piao		pian	pin	(piang)	ping
m ^j		mi		mie	miao	miu	mian	min		ming
d ^j		di	dia	die	diao	diu	dian	(din)	(diang)	ding
t ^j		ti		tie	tiao		tian	(tin)	(tiang)	ting
n ^j		ni		nie	niao	niu	nian	nin	niang	ning
l ^j		li	lia	lie	liao	liu	lian	lin	liang	ling
j		ji	jia	jie	jiao	jiu	jian	jin	jiang	jing
q		qi	qia	qie	qiao	qiu	qian	qin	qiang	qing
x		xi	xia	xie	xiao	xiu	xian	xin	xiang	xing
j		yi	ya	ye	yao	you	yan	yin	yang	ying
zh	zhe	zhei	zha	zhai	zhao	zhou	zhan	zhen	zhang	zheng
ch	che		cha	chai	chao	chou	chan	chen	chang	cheng
sh	she	shei	sha	shai	shao	shou	shan	shen	shang	sheng
r	re				rao	rou	ran	ren	rang	reng
g	ge	gei	ga	gai	gao	gou	gan	gen	gang	geng
k	ke	kei	ka	kai	kao	kou	kan	ken	kang	keng
h	he	hei	ha	hai	hao	hou	han	hen	hang	heng

Table 3: Structure of the Chinese word: combining onsets and rimes

The above analysis (shown in table 2) based on the overall symmetry of the consonantal system in terms of the occurrence of I in onsets greatly changes table 1. Firstly, by assuming the existence of a greater number of possible onsets it fuses the i-rimes with rimes without medials and shows that the former do not exist, they are just an illusion created by palatal onsets. Moreover, it dispenses with two traditional systematic gaps: (i) the absence of rimes without medials following palatals *j, q, x* and (ii) the absence of coronals *z, c, s* before i-rimes. The gaps disappear if we consider palatals *j, q, x* to be a variant of *z, c, s* before what is traditionally called i-rimes.

Secondly, the analysis also provides an account based on general, not language-specific theoretical principles for traditional i-rime gaps occurring with *r, g, k, h, zh, ch, sh* by providing the reason for absence of their palatal counterparts. The simple reason is that they contain I as a head and as such do not allow for the I operator in the same segment. Note that the analysis does not rely on any phonetic similarities among the members of the set *r, g, k, h, zh, ch, sh* but solely on their phonological behaviour.

The revised system can be found in table 3. Some rimes that are listed in the same column appear to have quite different surface realisations. With respect to columns *ei, ai* and *an* see footnote 7. In columns *ei, ou, en* and *eng*, operator I from the onset position of palatal consonants spreads into the nuclear position. In columns *ei* and *ou*, endings *i* and *u* influence the phonetic interpretation of the empty nucleus with non-palatals, cf. Neubarth & Rennison (2002:8). The gap with palatals in column *e* is not necessarily a gap: combining palatal onsets with rimes *e* and *ei* yields the same result. Finally, the gap in column *e* with labials probably contains forms with *-u* rime, see §3.5.

3.5. Beyond i-rimes

Although u-rimes are beyond the scope of this paper a glance at their distribution shows that an analysis somewhat similar to that of i-rimes could be applied for them. Let us sketch it briefly.

In GP labiality is connected with element U, therefore labialised onsets would be predicted to contain operator U. These are the consonants that are followed by u-rimes. On the other hand, consonants generally not followed by u-rimes would be predicted to contain U as head. These consonants seem to be the labials *p, b, m, f*. However, there is rime *-u* that does appear after them. I expect precisely forms *bu, pu, mu, fu* to fill the gap in column e in table 3, the details however still need to be worked out. The analysis of u-rimes would thus have to be able to account for this fact as well.

Besides rimes without medial, i-rimes and u-rimes Chinese also displays ü-rimes, which like i-rimes and u-rimes again seem to be a combination of ü and a rime without medial. In GP the melodic makeup of ü is generally represented by the combination of elements I and U. Since we have proposed that glides in rimes are in fact operators in onsets, we will assume that in the case of ü-rimes both I and U will be operators in the onset. Let us see where this assumption gets us. A closer look reveals that ü-rimes seem to occur only after onsets that also take i-rimes. Effectively this means that they occur with palatal onsets.⁸ There is however a set of consonants that do take i-rimes but not ü-rimes, namely the labials *p, b, m, f*. Above we have proposed that precisely these consonants contain U as a head. It follows from a general principle prohibiting a double occurrence of the same prime in one segment that these consonants will not be able to contain an operator U. This is exactly what the distribution of ü-rimes shows.

However, there are two consonants our theory would predict to occur with ü-rimes, but in reality never do, namely *d, t*. These are precisely the two consonants that for Kaye (2001b) do not contain I operator. By proposing so, the problem of absence of ü-rimes does not appear for Kaye. On the other hand, these two consonants do appear before i-rimes, therefore he needs to predict the existence of lexical i-rimes. This, we have shown, is unsuitable for other reasons. Acknowledging that *d, t* are problematic for our theory at the present stage we leave this problem unsolved for the time being and call for further research.

4. Conclusion

In this paper I proposed a new analysis of the melodic structure of segments that can appear word-initially in Mandarin Chinese regarding their ability to precede what is traditionally called i-rimes. The analysis was led by phonological behaviour of consonants combined with the idea of the overall symmetry of the consonantal system. The merit of this proposal is that it goes beyond observation and provides explanation stemming from general principles of Government Phonology.

The proposal followed the idea that *i* is never lexically present in the vocalic part of the syllable, which means that there are no lexical i-rimes. The source of *i* in these rimes is always the consonant. We determined the status of element I and its general behaviour in these consonants and reached the following conclusions: consonants without I and consonants with I-head do not appear with i-rimes, while I-operator consonants (the palatal counterparts of the I-less consonants) always do. Applying the Free Distribution Principle to the Cartesian product of the proposed onset segmental inventory and the set of rimes without medial explains the systematic gaps in the distribution of i-rimes.

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⁸After palatals we can also find a rime *-iong*, which is phonetically realized with u, not ü. The question why we get this sort of phonetic realization is left for further research.

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