ALAN C. L. YU

INFIXING WITH A VENGEANCE:
PINGDING MANDARIN INFIXATION*

In the Pingding dialect of Mandarin, the infixing of a retroflex lateral, -ɭ-, before the nucleus marks diminutive. Pingding infixation not only creates onset clusters but also introduces a phoneme. Both features are otherwise not found elsewhere in the language. We argue that the infix -ɭ-, which is cognate with the diminutive -r suffix in other Mandarin dialects, is the result of rhotic metathesis (cf. Blevins and Garrett (1998)). This study shows that Pingding infixation presents an interesting challenge to the theory that claims sound change/metathesis is perceptually optimizing and that it is goal-driven (Hume (1997, 1998, 2001), Steriade (2001)). In this paper, we advance a theory of the origin of Pingding infixation, based on the listener-oriented (i.e., 'innocent') view of sound change (Ohala (1993)), which accounts for the appearance of -ɭ- as an excrescent segment through acoustic means, rather than articulatory (Chen (1992)) or phonotactic ones (Lin (2002)).

1. INTRODUCTION

Diminutive formation in the Pingding dialect of Mandarin involves the insertion of the infix -ɭ- after the initial consonant of a word. This infixation pattern is extremely puzzling given what we know about the general phonology and morphology of Standard Mandarin Chinese. Various synchronic analyses have been advanced in the past (Yip (1992), Chen (1992), Lin (2002)), yet the origin of this pattern remains illusive. In this paper, we argue that the infixation pattern was the result of a set of individual phonetically natural sound changes whose cumulative effects resulted in a highly unnatural and seemingly unmotivated synchronic pattern of infixation. This study not only resolves an interesting puzzle in Chinese phonology and morphology but also contributes to current debates on the nature of sound change.

The structure of this paper is as follows: we begin with an introduction of Pingding infixation, noting its implications for current theories of sound change in Section 2. We then review the facts of *er*-suffixation in Standard Mandarin Chinese in Section 3, proposing that ɭ-infixation in Pingding was the result of rhotic metathesis. In Section 4, we provide supporting evidence of the metathesis origin of ɭ-infixation based on data from the Yanggu dialect of Mandarin. We then relate the development of Pingding infixation to the *l*-split words in several dialects of Shanxi Mandarin in Section 5. The conclusion appears in Section 6.

2. $\underset{\centerdot}{l}$-INFIXATION IN PINGDING MANDARIN

Pingding Mandarin is a dialect of Mandarin Chinese spoken in the Shanxi province of China. Like most Mandarin dialects, Pingding has a diminutive/hypocoristic affixation process. However, unlike the other dialects, where this process is marked by the suffixing of a retroflexed morpheme (i.e., *-er*), the cognate morpheme in Pingding, realized as a retroflex lateral -$\underset{\centerdot}{l}$-, is infixed between the onset and the rhyme of a syllable.

(1)   Pingding $\underset{\centerdot}{l}$-infixation (Xu 1981)

mən	tuʁŋ	+	l̺	→	mən	tl̺uʁŋ	'hole on the door'
lɒɔ	tʰʁu	+	l̺	→	lɒɔ	tʰl̺ʁu	'old man'
ɕiɒɔ	pʁŋ	+	l̺	→	ɕiɒɔ	pl̺ʁŋ	'small notebook'
xʁu	mʁŋ	+	l̺	→	xʁu	ml̺ʁŋ	'back door'
ɕiɒɔ	kuʁ	+	l̺	→	ɕiɒɔ	kl̺uʁ	'small wok'
xuɑŋ	xuɑ	+	l̺	→	xuɑŋ	xl̺uɑ	'yellow flower'
ŋʁ		+	l̺	→	ŋl̺ʁ		'moth'

This infixation pattern is extremely puzzling given what we know about the general phonology of Mandarin Chinese. To begin with, the syllable structure of Chinese languages is straightforwardly (C)(G)V(C), where 'G' stands for a glide (i.e., *j* or *w*). Thus, it is surprising that infixation should create onset clusters which are otherwise not attested elsewhere in the language. On top of that, a retroflex lateral is not commonly found in descriptions of Mandarin phonetic inventory (e.g., Chao (1968), Li and Thompson (1981), Duanmu (2000)). The appearance of a retroflex lateral only in forms with infixation also demands an explanation.

The fact that onset clusters should be tolerated just in the case of infixation blatantly contradicts the hypothesis that infixation is a matter of prosody-optimization (McCarthy and Prince (1993)). Lin (2002), who explores the implications of Pingding infixation in the context of McCarthy and Prince's theory of infixation, notes that there is at least one redeeming aspect of $\underset{\centerdot}{l}$-infixation, that is, it follows the Sonority Sequencing Constraint. However, recent work on the positional markedness effects of retroflexion (Steriade (1995)) has demonstrated that retroflexion is perceptually most salient in post-vocalic positions. Thus, the 'migration' of [l̺] to post-consonantal position only endangers the identification of the retroflex feature, rather than enhancing it.

This pattern of infixation also poses an interesting challenge to approaches of phonology that assume speakers have phonetic knowledge of what is marked or unmarked in speech (i.e., Flemming (1995), Steriade

(1995, 1997)). This line of argument has been specifically pursued to account for metathesis (i.e., Hume (1997, 1998, 2001), Steriade (2001)). To foreshadow a little, we will ultimately argue that *l*-infixation came from rhotic metathesis. Thus, if Hume and Steriade's theory of metathesis is correct, then it is puzzling that the speakers of Pingding Mandarin not only opted for a novel way of affixation in Chinese, namely infixation, but also allowed the creation of onset clusters in the process even though alternatives that are less 'marked' typologically or more optimizing prosodically or phonetically are readily available (e.g., turning the suffix into an prosodically independent word; turning the suffix into a coda consonant, as in many other Mandarin dialects).

Given this whole array of problems raised by the Pingding pattern and its implications for current theories of phonology and sound change, the time seems ripe to consider how such a 'marked' infixation pattern arises and under what circumstances. But to understand the genesis of this peculiar infixation pattern, it is helpful first to review some of the basics regarding diminutive formation in Standard Mandarin. This will set the stage for the subsequent discussions.

3. *Er*-DIMINUTIVE FORMATION IN STANDARD MANDARIN CHINESE

Standard Chinese, which reflects the Beijing dialect of Mandarin, uses the [ɹ] suffixation process to mark diminutive. Historically, this retroflex suffix came from the word [ɚ] 'son', which later grammaticalized into a morpheme that denotes smallness (see Jurafsky (1996) on parallel semantic changes). However, in present-day usage, the notion of smallness is no longer important. Rather, it has become more like a stylistic feature rather than a grammatical one (cf. Duanmu (2000)). Let us now briefly describe the basic facts of Standard Chinese *er*-suffixation. This description is adopted directly from Duanmu (2000).

Given the fact that *er*-suffixation in Standard Chinese does not affect the initial consonant, Chinese linguists traditionally concentrate on the influence of the *-r* suffix on the rhymes only. Standard Chinese has nineteen rhymes. The distribution among certain rhymes is neutralized when the *-r* suffix is added, as illustrated below:[1]

(2)   Unsuffixed (19 rhymes)   Suffixed (11 rhymes)

      z, ɹ, əi, ən   əɹ
      a, ai, an   aɹ
      o   oɹ
      u   uɹ

ɣ	ɣɹ
au	auɹ
əu	ɹuɹ
əŋ	ə̃ɹ
aŋ	ã ɹ
uŋ	ũ ɹ
e	eɹ
(i, in	iəɹ)
(y	yəɹ)

Duanmu (2000, p. 197) parenthesizes the last two rows to indicate that the rhymes in the suffixed form contain the sequence [əɹ], which is the same as that of the first line. He therefore analyzes the nineteen unsuffixed rhymes as reduced to eleven suffixed ones.

Given the diminutive formation pattern in Standard Mandarin, the source of the Pingding infix, -ļ-, seems clear: it developed out of the suffix -r. The question we now turn to is the nature of the mechanism that accounts for this suffix-to-infix change.

4. Pingding Infixation as Rhotic Metathesis

The hypothesis we will develop here is that Pingding infixation was the result of metathesis of the suffix -r from post-vocalic to pre-vocalic position. Rhotic metathesis is commonplace in the world's languages. This is, for example, found in the history of English (e.g., *third* < OE *Þridda*, bird < OE *brid* (but see Ritchie (1999) for a different interpretation of this change). A more systematic case of rhotic metathesis can be found in Le Havre French (Grammont (1909), Blevins and Garrett (1998)). When a rhotic is in an unstressed syllable, preconsonantal *rə* metathesized except when immediately followed by labial fricatives (*f*, *v*) or the labial nasal *m*, as illustrated below. The original position of *r* is reflected in the standard French forms in the glosses.

(3)   Le Havre French

    a. Rhotic metathesis

       bərdɛl   'suspenders, bretelle'
       bərbi   'ewe, brebis'
       fərʃɔ̃ne   'to shiver, frissonner'
       fərlyk   'tuft, freluche'
       fərtije   'to wag (a tail), to wriggle, frétiller'
       gərzi   'sleet, grésil'
       gərnje   'granary, grenier'

b. No change

ekrəviʃ   'crayfish, écrevisse'
krəvaʃ   'crack, crevasse'

Blevins and Garrett (1998) attribute the cause of rhotic metathesis to listener confusion fueled by the long phonetic cues of rhotics (e.g., lower F3). That is, since the vowel in an unstressed syllable is relatively short, the coarticulatory acoustic cues of the rhotic permeate the unstressed vowel, making it difficult for the listener to recover the actual location of the rhotic. In Le Havre French, what apparently happened is that some speakers misinterpreted the location of the rhotic as prevocalic rather than post-vocalic, thus resulting in the current metathesized forms.

Recent research on liquids has verified their extensive local and non-local coarticulatory effects. For example, West (1999, 2000) found, in Southern British English, significant lowering of F3, more lip rounding, and backer and higher tongue position of vowels preceding an [ɹ]. Such co-articulatory effects are both anticipatory and perseveratory. West also found significant non-local coarticulatory effects extended up to two syllables preceding the liquid in question. Chen (1992), comparing the Beijing postvocalic [ɹ] described in Wang and He (1985) to the American English variety as described in Potter et al. (1947), observed that the curling of the tongue begins earlier in the rhyme in Beijing Mandarin than in American English. These phonetic studies, therefore, point to the significant anticipatory coarticulatory effect of liquids and, specifically, [ɹ]. Thus, following the listener-oriented theory of sound change (i.e., Ohala (1993)) and its application to the understanding of the causes of metathesis (Blevins and Garrett (1998, in press)), the fact that the post-vocalic diminutive suffix -r in Mandarin surfaces in prevocalic positions in Pingding Mandarin can now be analyzed as a hypercorrective response to the extensive anticipatory effect of -r. That is, the unintentional anticipatory effect of -r causes the preceding vowel to be heavily rhoticized. This presents to the listener a problem in localizing the coarticulatory effect since the rhoticization could be caused by either a prevocalic or postvocalic retroflex. The ancestral Pingding speakers opted for a prevocalic analysis, hence the seed of diminutive infixation in Pingding. One crucial difference between Pingding rhotic metathesis and similar sound changes which occurred in Le Havre French and English is that rhotic metathesis in Pingding has grammatical consequences. That is, a previously suffixing morphological process is now an infixing phenomenon.

The puzzle, at this point, is why the diminutive infix is not a straight-forward -r- in Pingding. Why should it be a retroflexed lateral -ɭ-? We might

begin with the observation that, phonetically speaking, laterals and rhotics are quite similar. In fact, languages such as Japanese treat *l* and *r* as free variants of each other. Chao, in his seminal *A Grammar of Spoken Chinese* (1968, pp. 46–52), which adopted the orthographic convention of GwoyeuRomatzyh (National Romanization), represented the suffix *-r* as *-l*. This hints at the fact that perhaps the diminutive suffix is underlyingly a lateral in the mind of a Mandarin speaker. However, this analysis is quite at odds with the predominant view adopted by most students of Chinese phonology, who typically treat the final suffix as an allophone of the phoneme /r/, rather than /l/ in Mandarin (e.g., Hartman (1944), Duanmu (2000)). Why then would a lateral emerge out of nowhere? The answer, we argue, lies in a similar construction found in the Yanggu dialect of Mandarin.

4.1. *Diminutive Formation in Yanggu Mandarin*

Yanggu is a dialect of Mandarin spoken in Shandong. Yanggu has twenty three onset consonant types (i.e. p, pʰ, m, f, t, tʰ, n, l, k, kʰ, x, ɣ, tɕ, tɕʰ, ɲ, ɕ, tʂ, tʂʰ, ʂ, ʐ, ts, tsʰ, s) and thirty-nine rhymes (i.e. z̩, ʐ̩, i, u, y, a, ia, ua, ɛ, iɛ, uɛ, ie, ə, ɤ, uɤ, ao, iao, ou, iou, ɤi, uɤi, ãn, iãn, uãn, yãn, ɤ̃n, ĩn, uɤ̃n, ỹn, ãŋ, iãŋ, uãŋ, ɤŋ, iɤŋ, ũŋ, ỹŋ, m̩, l̩).

The diminutive construction in this dialect varies depending on the shape of the lexical host to which it is attached. The general pattern is the suffixing of [ɹ], similar to what happens in Standard Chinese.

(4)		Root	Diminutive	Gloss		Root	Diminutive	Gloss
	a.	tʂʐ̩	tʂɤ�̩ɹ	'stick'	m.	kʰɤŋ	kʰɤɹ	'ditch'
	b.	tʂʰa	tʂʰaɹ	'fork'	n.	pu	puɹ	'cloth'
	c.	kɛ	kɛɹ	'cover'	o.	kua	kuaɹ	'melon'
	e.	tʂʰə	tʂʰəɹ	'car'	p.	kuɛ	kuɛɹ	'cane'
	f.	kɤ	kɤɹ̩	'pigeon'	q.	uɤ	uɤɹ	'pot'
	g.	ʂɤi	ʂɤɹ̩	'color'	r.	xuɤi	xuɤɹ̩	'dust'
	h.	pao	paoɹ	'bun'	s.	uãn	uɛɹ	'bowl'
	i.	xou	xouɹ	'monkey'	t.	uɤ̃n	uɤ̃ɹ̩	'wrinkle'
	j.	pãn	pɛɹ	'class'	u.	kʰuãŋ	kʰuaɹ	'basket'
	k.	kɤ̃n̩	kɤ̃ɹ̩	'root'	v.	kũŋ	kuɤɹ	'bow'
	l.	kãŋ	kaɹ	'basin'				

However, when the word begins with a dental/alveolar consonant [t, tʰ, n, ts, tsʰ, s], an [l] appears prevocalically after the initial consonant, concomitant with the suffixing of [ɹ].

(5)

	Root	Diminutive	Gloss		Root	Diminutive	Gloss
a.	tsa	tslaɹ	'yesterday'	g.	tʰã̃ŋ	tʰlaɹ	'soup'
b.	tsʰɛ	tsʰlɛɹ	'vegetable'	h.	tʰu	tʰluɹ	'rabbit'
c.	tao	tlaoɹ	'knife'	i.	tsuɤ	tsluɤɹ	'seat'
e.	tsou	tslouɹ	'walk'	j.	tuã̃n	tluɛɹ	'group'
f.	sã̃n	slɛɹ	'three'	k.	tũŋ	tluɤɹ	'cave'

It should be emphasized that [l] appears only after a dental consonant, not after coronals in general, as we do not find [l] surfacing in retroflex obstruent-initial words.

(6)

Root	Diminutive	Gloss		Root	Diminutive	Gloss
tʂʐ̩	tʂɤɹ	'stick'	vs.	tsa	tslaɹ	'yesterday'
tʂʰa	tʂʰaɹ	'fork'	vs.	tao	tlaoɹ	'knife'
ʂɤi	ʂɤɹ	'color'	vs.	sã̃n	slɛɹ	'three'

When the nucleus is a high front vowel (i.e., ʐ̩, i, y), -*l* is suffixed to the word.

(7)

	Root	Diminutive	Gloss		Root	Diminutive	Gloss
a.	pʰi	pʰil̩	'skin'	h.	i	il̩	'clothes'
b.	sʐ̩	sl̩	'silk'	i.	tsʐ̩	tsl̩	'word'
c.	tɕy	tɕyl̩	'saw'	j.	y	yl̩	'fish'
e.	ɕĩn	ɕil̩	'heart'	k.	ĩn	il̩	'stamp, seal'
f.	tɕʰỹn	tɕʰyl̩	'herd'	l.	tʰɤi	tʰɤl̩	'leg'
g.	tsʰuɤ̃n	tsʰuɤl̩	'village'	m.	tsuɤ̃n	tsuɤl̩	'mount'

What is most peculiar is when the nucleus is a diphthong that begins with a high front vowel, an [l] appears after the high front vowel; this, along with the suffixing of [ɹ], thus creates a disyllabic output.

(8)

	Root	Diminutive	Gloss		Root	Diminutive	Gloss
a.	ia	ilaɹ	'duck'	h.	iã̃ŋ	ilaɹ	'shape'
b.	iɛ	ilɛɹ	'cliff'	i.	iɤŋ	ileɹ	'shadow'
c.	tie	tileɹ	'plate'	j.	yɤ	ylɤɹ	'medicine'
e.	iao	ilaoɹ	'waist'	k.	yã̃n	ylɛɹ	'garden'
f.	iou	ilouɹ	'oil'	l.	ɕỹŋ	ɕylɤɹ	'bear'
g.	iã̃n	ilɛɹ	'smoke'				

The task here is to account clearly for the appearance and the distribution of the lateral in Yanggu diminutive formation just in the case where the initial consonant is dental or where the rhyme includes a high front vowel.

Yip (1992) proposes that the diminutive is associated with a floating lateral feature. This feature, in deference to the Sonority Sequence Constraint, docks right after the initial consonant, yielding the appearance of an infix. From a synchronic point of view, such an analysis is at first glance not implausible; from the perspective of understanding the origin of the pattern, however, attributing the appearance of a lateral on the surface to an underlying floating lateral feature does not actually resolve the question of where that lateral feature comes from in the first place.

Chen (1992), in response to Yip's analysis, proposes that the lateral is an emergent segment that springs up between two coronals with antagonistic tongue shapes (i.e., from a dental coronal to a rhotacized vowel).[2] Despite the fact that Chen intends his analysis to be a treatment of the synchronic status of the lateral, the ramifications of Chen's general approach to the appearance of the lateral for our understanding of the historical origin of the Yanggu pattern are clear. Under Chen's view, the excrescent lateral is nothing more than a fossilized emergent segment, similar to the [p] in the words such as *Thompson* (< *Thom* + *son*) *dempster* (< *deem* + *ster*) in English (see Ohala (1997)). The main point of contention here is what the proper characterization of the emergent segment is. Is it the result of antagonistic tongue gestures as Chen proposed or a matter of perceptual confusion (cf. Ohala (1997))?

To understand this, we must first understand the acoustic properties of the anterior sounds,[3] namely the high front vowels and the dental consonants, since a lateral only emerges after them. Anterior sounds typically have low F1 and relatively high F3. The acoustic correlates of a rhotacized vowel, on the other hand, are such that F3 is often rather low with possible lowering of F1 also. Recall now that the onset of curling of the post-vocalic -*r* in Mandarin begins earlier than the American English counterpart (Wang and He (1985), Chen (1992)). This would mean that the transition from an anterior sound to the rhotacized vowel could be rather drastic. If this abrupt transition were prolonged, it might yield a percept of a transitional approximant. This unintended approximant could then be interpreted as a purposeful gesture and could subsequently be phonemicized as a retroflex lateral. This is a classic scenario of hypercorrection (Ohala (1993)) whereby a speaker misinterprets unintended coarticulatory effect as purposeful gesture. Thus, contrary to Chen (1992), we propose that it is not that [ɹ] and [i, y, n] have antagonistic gestures. Rather, it is the acoustic correlates of the coarticulatory effects of [ɹ] that are 'antagonistic' to those of anterior sounds, which in turn gave rise to the possibility of creating the percept of a transitional retroflex lateral.

Notwithstanding our understanding of the sudden appearance of an

approximant prevocalically, the fact that the emergent segment is a lateral remains a recalcitrant problem. That is, why is the emergent approximant not a retroflex [ɻ]? Where did the laterality come from? Notice our earlier observation that the phonetic similarity between laterals and rhotics does not bear any force in the present context since the emergence of *l* occurs only in a restricted set of environments, namely only after anterior segments. If it were a genuine case of *r* becoming *l* due to the free variation between *l* and *r*, as found in Japanese, such restrictions would not be expected.

Hartman, in a footnote of his 1944 paper on Mandarin phonology, points out that the initial [ɹ] in Mandarin, which he represents as a retroflex [ʐ] due to the slight frication of [ɹ] in initial position, is usually modified by a slight lateralization (Hartman (1944, fn 16)). Thus, given the propensity for prevocalic [ɹ] to be slightly lateralized and the fact that, perceptually, a rhotic [ɹ] and a retroflex lateral are also quite similar in general, it is not entirely surprising that in the event of perceptual confusion, some lateral-like segment is posited rather than [ɹ]. Moreover, while Dong (1985) transcribes the Yanggu infixing lateral as a plain lateral, in Footnote 3, he does acknowledge the fact that this lateral is slightly further back, very similar to a retroflex sound (Dong (1985, p. 276)). Dong also points out that the vowels that follow the inserted [l] are invariably rhotacized (Dong (1985, fn 5)), thus further supporting the idea that the sound represented as *l* there might be more accurately transcribed as [ɭ]. Yet this answer to the emergent laterality mystery is not entirely satisfying. It still does not explain why we should not expect a slightly lateralized rhotic rather than a slightly retroflexed lateral. To this end, we suggest that the answer lies again in the acoustics.

The acoustic correlates of a lateral are such that the first formant is typically rather low while the third formant is rather high, coinciding with the acoustic correlates of the anterior sounds. Thus, it makes sense that if the listener were to confuse the abrupt transition as an unintended segment, that segment should have an inherently high F3 also. [ɹ], on the other hand, typically has extremely low F3; thus the transition from an [ɹ] to a rhotacized vowel would not be obvious at all. Hence the possibility of confusing the transition as an [ɹ] is rather low. This analysis also provides a natural explanation why retroflex obstruents do not condition the emergence of the lateral since the F3 of the offset of a retroflex obstruent would also be low, compared to the alveolar ones.[4]

Thus the fact that the emergent approximant after an anterior sound is a lateral in the above-mentioned dialects of Mandarin Chinese is in fact quite understandable in perceptual terms.

4.2. *Pingding Infixation Explained*

Now that we have elucidated the diminutive formation in Yanggu, it is time to return to our original goal of understanding the origin of the Pingding infixing diminutive formation. How does Yanggu shed light on what is going on in Pingding?

We contend that the Yanggu pattern represents the missing link between Standard Chinese *er*-suffixation and the present-day Pingding infixing pattern. Before the development of a full-blown infixing pattern in Pingding, there must also have been a stage where the original final -*r* was lost, leaving the alternation between the infixing retroflex lateral in words with anterior sounds and regular *er*-suffixation in other forms. This stage is analogous to the loss of the conditioning final high vowel suffix in the history of umlaut in Germanic languages (Hock and Joseph, 1996, p. 128):

(9)   Stage I   Stage II   Stage III

        (= pre-Old English. I)   (= pre-Old Engl. II)   (= Old English)
        kū-z   kū-z   cū [kū] 'cow'
        kū-iz   kǖ-iz   cȳ [kǖ] 'cows'

While there are rhotic-closing syllables in Mandarin aside from those created by *er*-suffixation, the Pingding data available at present, unfortunately, do not provide conclusive evidence that all syllables closed with a final rhotic were independently lost in this dialect. However, other dialects of Mandarin Chinese in the vicinity of where Pingding is spoken provide crucial evidence that the loss of final -*r* was across the board. Qian et al. (1985) report that the words 'child, ear, two', all pronounced as [ɚ] in Standard Chinese, are pronounced as [ɭə] in some dialects of Mandarin in the Pingdu county of the Shandong Province while other dialects within the same county vary between [ɚ] and [ɭə].

Once the rhotic metathesis sound change was complete, the pressure of paradigm leveling must have subsequently caused the regularization of the infixing pattern. This new infixation pattern requires that -*ɭ*- be inserted before the nucleus. Thus, when a word is vowel-initial, -*ɭ*- appears as prefixing ((10)).

(10)   uɣ   ɭuɣ   'pot'

This entire series of changes of what was originally *er*-suffixation is schematized in (11) below:

(11)   A summary of the development of *l̺*-infixation in Pingding

Stage	Pattern	Notes	Example
1	Er-suffixation		Pekingese
2	Er-suffixation plus allophonic [l] insertion	Conditioning factors of [l] insertion present	Yanggu
3	Er-suffixation vs. *l*-infixation	Conditioning factor lost	Unattested
4	*l̺*-infixation	Leveling	Pingding

It is interesting to note that, true to its original post-anterior pattern, the high front vowel of a high-vowel-initial word spirantizes in Pingding, giving the impression of an infixing -*l̺*- (12). Since spirantization of high front vowels created more surface -*l̺*- infixed forms, it might have facilitated the eventual leveling toward the infixation pattern.

(12)   iɤŋ   zl̺ɤŋ   'shadow'
        y   zl̺ʊ   'fish'
        yeʔ   zl̺uɤ   'moon'

The fact that a high vowel should spirantize before a retroflex lateral is likely the result of aerodynamic considerations. The spirantization of high front vowels is commonplace in most Mandarin dialects. As Xu (1981) points out, there are other closely related dialects where words that begin with a high front vowel already spontaneously develop frication, suggesting that high front vowels in Mandarin are articulated very close to the upper palate. When the channel between the tongue blade and the upper palate is narrow enough, turbulence might ensue, resulting in audible turbulent frication (see Yu (1999) for more discussions on the aerodynamic conditions of vocalic spirantization in Chinese).

(13)   'fish'   'medical'

        Pingding   y   i
        Yushe   ɥ$_z$ ɿ$_z$^{5}
        Fenyang   zɥ$_y$ zɿ$_i$
        Sinyuan   zɥ   zɿ
        Lishe   zu   zɿ

In the present case, when a high front vowel is followed by a lateral segment, the anticipatory gesture of the following lateral might have pulled the high

front vowel closer to the upper palate, creating the possibility of turbulence as mentioned above.

4.3. *Miscellaneous Complications*

There are a few more details about Pingding infixation that deserve elaboration. Consider the following data:

(14) a. tɕiæ̃   tsɭɐ   'pointed, shape'
     b. tɕiɤŋ   tsɭɤŋ   'today'
     c. tɕi   tsɭə   'chicken'
     d. tɕʰiæ̃   tsʰɭɐ   'money'
     e. tɕʰiɤu   tsʰɭɤu   'ball'
     f. tɕʰieʔ   tsʰɭɒɔ   'bird'
     g. ɕiɤŋ   sɭɤŋ   'heart'
     h. ɕiɤŋ   sɭɤ   'peach seed'
     i. tɕʰyæ̃   tsʰɭuɐ   'circle'

When a consonant-initial word contains a high front vowel in the rhyme, in the event of infixation the high front vowel disappears. Initial consonants, moreover, depalatalize. The fact that the initial consonant should depalatalize is understandable since the conditioning factor, namely the high front vowel that follows it, is absent. Yet how do we account for the deletion of the high front vowel in the case of infixation?

Given the propensity for high front vowels to spirantize before [ɭ] in Pingding in general, one might treat the high front vowels as being absorbed into the preceding frication. This explanation is not entirely satisfactory since some of the initial consonants are aspirated, which means that the 'spirantized' high front vowel cannot be 'absorbed' by the preceding frication. How then can this deletion of high front vowels be accounted for?

Lin (2002), working within the framework of Optimality Theory, suggests that the high front vowels are deleted due to their incompatibility with retroflexion. But as we have observed in the Yanggu dialect, the appearance of [ɭ] can induce the creation of a disyllabic form (e.g., *ia* 'duck' becomes *i.laɹ*). Why is this possibility not available in Pingding?

The answer, we argue, lies in the perceptual domain. As argued above, laterals have acoustic correlates similar to those of anterior sounds. The class of anterior sounds involved, however, is not homogeneous. Particularly, the high front vowels are quite different from, say, the coronal obstruents. It is this difference that gives rise to the substitution effect of [ɭ] in (14). The [ɭ] did not actually 'replace' the high front vowels. Rather, the high

front vowels, which are actually phonetic glides, as commonly assumed in the Chinese phonological and phonetic literature, were colored by the rhotic character at the stage when the language underwent rhotic-metathesis. This coloring gave rise to the percept of an [l̩] of the underlying high front vowels. Thus, unlike the source of the general [l̩] infix, the [l̩] that 'replaces' a high vowel actually was a high vowel historically.

The data in (14) also demonstrates another complication: vowel nasalization does not surface in the diminutive forms. Some of the relevant data are reproduced in (15).

(15) a. tɕiæ̃   tsl̩ɐ   'pointed, shape'
     d. tɕʰiæ̃   tsʰl̩ɐ   'money'
     i. tɕʰyæ̃   tsʰl̩uɐ   'circle'

This alternation, at first glance, seems puzzling. There is no *a priori* connection between nasalization and infixation. Further examination, however, reveals that a significant interaction between nasalization and lateral infixation exists. First, nasal-initial words in Pingding never participate in l̩-infixation (Xu (1981)). Thus, the fact that nasalization does not show up in the diminutives reflects this general incompatibility. More importantly, the fact that diminutive forms lack nasalization actually falls out naturally from the historical scenario argued in this paper. First, we should point out that the un-infixed forms in (15) correspond to *n*-final words in Standard Mandarin. As noted earlier, in other Mandarin dialects, the coronal codas [i] and [n] are deleted in the event of *r*-suffixation. This means that at some stage, for example, the rhyme [an] appeared as [ar] in the diminutive (see Stage I in (16)). At some point in the history of Pingding, the final [n] induced nasalization on its preceding vowel and dropped out ([an] > [ã]; see Stage II in (16)). Given the fact that nasalization is only relevant to original coronal nasal-final forms, the diminutive words, which were *r*-final before rhotic metathesis, should remain oral (see Stage III in (16)). We have no reason to expect these diminutive forms to develop nasalization spontaneously.

(16) Stage Normal rhymes Diminutive rhymes
      I   ən   əɹ   Before nasalization
      II   ã   aɹ   After nasalization
      III   ã   ɹa > l̩a   Rhotic metathesis

What the historical scenario demonstrates is that, since there was no nasalization on these diminutivized rhymes to begin with, there is nothing

to explain in terms of why there is a correspondence between non-diminutive [ã] versus diminutive [ɭa]. In a synchronic analysis that sought to relate the diminutive forms to its base, one needs only to posit a co-occurrence restriction between adjacent nasalization and the retroflex lateral.

The theory advanced thus far presupposes that the lateral in Pingding and Yanggu derived historically from the suffix *-er*. However, the fact that the onset clusters created by infixation involve a lateral raises the suspicion that the observed infixation phenomenon might be a remnant of historical onset clusters. Sagart (1999), for example, argues that Old Chinese has an intensive infix *-r-*. His arguments come from a pattern that is quite reminiscent of ɭ-infixation in Pingding. This is what we will turn to next.

5. FISSION IN SHANXI MANDARIN

In some dialects of Mandarin spoken in the Shanxi providence, certain words, when compared to the Standard Chinese counterparts appear to be split into two syllables by way of an inserted [l].

(17)	Tai-yuen	pæ̃	>	pəʔ læ̃	'to be tripped'
	Henan	pai	>	pəʔ lai	'to shake'
	Ting-an	pæ	>	pəʔ læ	'to be tripped'

This type of *l*-separated bisyllabic words is common in the Jinzhong dialect of Mandarin. The first syllable typically ends with the rhyme, *-əʔ*, while the second syllable always begins with [l].

(18)   Jinzhong *l*-separated words (Chao (1979))

məʔ lau	'to caress'	kəʔ liaʔ	'to squint'
pəʔ ləŋ	'stupid'	kəʔ lau	'to stir'
pʰəʔ ləŋ	'to struggle'	kuəʔ liou	'to roll'
məʔ lyəʔ	'to wipe off'	kʰəʔ lɒ	'empty'
təʔ liaʔ	'talkative'	xu luŋ	'to bamboozle'
tʰəʔ ləŋ	'support frame'	tsəʔ leŋ	'lopsided'
tʰəʔ lə	'to drag'	tɕiəʔ liŋ	'smart'

5.1. *Metathesis-induced or Inherited Infixation?*

Sagart (1999) argues that the patterns found in dialects like Jinzhong are reflexes of an Old Chinese intensive infix *-r-*. This then raises the possibility that the Pingding pattern is also the reflex of this historical intensive

infix which has serious implications for our theory of the origin of Pingding infixation since we would be forced to assume that Pingding infixation is inherited rather than a subsequent development within Mandarin dialects such as Yanggu and Pingding.

Sagart's interpretation, however, fails to explain to the intricacies displayed by the patterns found in Yanggu and Pingding. Moreover, while syllable-initial consonant sequences, especially consonant+approximant sequences (e.g., *kl*, *pr*), is not altogether foreign to Chinese historical phonology (e.g., Li (1980), Baxter (1992)), such sequences are reconstructed for Old Chinese, not for Middle Chinese. Thus, there is an important gap between Old Chinese and the modern dialects such as Pingding that requires explanation. It is also not entirely clear why the reflex of the hypothetical infix -*r*- is a retroflexed lateral rather than a straightforward -*r*-. In light of these inadequacies and the many unanswered questions, the proposal that claims Pingding infixation as the reflex of historical intensive infix remains tentative at best.

Here, we will argue that the situation is actually the reverse. The Jinzhong pattern is derived, at least partly, from patterns like Pingding infixation. That is, what happened in Jinzhong and the other Shanxi dialects can be seen as a next logical step toward a situation similar to what is found in Pingding today (cf. Xu (1981)). Previously infixed diminutive words are split into two syllables. The question here is, of course, how these split syllables developed in the first place. Some might be tempted to analyze this as a syllable structure improvement strategy. That is, the avoidance of onset clusters prompted speakers to develop an alternative way to handle the present of -*l*-. In this case, an unmarked vowel, ə, is inserted. This teleological understanding, we shall maintain, is unnecessary. Xu (1981) points out that a transitional [ə] is often heard between the initial consonant and the inserted -*l̩*- in Pingding (e.g., *tl̩ɤu* 'bean.dim' > [tˀl̩ɤu]; *tʰl̩aŋ* 'hall.dim' > [tʰˀl̩ɑŋ]). A listener can confuse this excrescent [ə] as an intended segment. This is, once again, another instance of hypercorrection. An unintended transitional [ə] is misinterpreted as purposeful, i.e., part of the underlying structure of the word. This is also potentially an instance of how a phonological system can affect the direction of sound change. The fact that the transitional [ə] is misunderstood as underlying might be guided by the fact that the syllable structure of Chinese does not generally allow onset clusters.

This interpretation of the Jinzhong pattern is, however, not without flaw. The examples in (18) involve mainly verbs and a few adjectives. Pingding infixation, however, generally applies to nouns. Thus, there

is an important discrepancy between the two patterns. Nonetheless, we argue that at least some of the Jinzhong split words have their origins in historical infixed words like those found in Pingding. Evidence for this view comes from the following nominal forms in Jinzhong ((19)).

(19)   təʔ lau   'head'
        pəʔ læ̃   'basket'
        xəʔ lɒ   'alley'
        kʰueʔ lyɛ   'circle'

While we cannot establish a firm connection between Pingding infixation and the split-words in Jinzhong based on the few forms above, the potential connection between these patterns, however, remains suggestive.

6. Discussions and Conclusions

We began this paper with the observation that Pingding ɭ-infixation is highly unusual from the perspective of Chinese phonology since it not only introduces a segment that is not common in the segmental inventory of Chinese, namely a retroflex lateral, but also generates onset clusters that are otherwise unheard of elsewhere in the language. However, from the perspective of a listener-oriented theory of sound change, we conclude that ɭ-infixation was really just the result of a more elaborate version of rhotic metathesis. That is, the emergence of [ɭ] is due to the possibility of a listener's being unable to recover the historically more accurate position of the rhotic. The pattern in Yanggu reflects the intermediate stage where both the emergent [ɭ] and the suffix -r are present in the output. What is unconventional about the Pingding pattern is that, unlike canonical instances of rhotic metathesis (e.g., in English and Le Havre French), the output of metathesis is not entirely congruous with the original content. That is, a *Vr* sequence did not become *rV*; one finds ɭ*V* instead. To this end, we advanced a theory that relies on the fact that the acoustic property of the aforementioned emergent segment is more in line with the acoustic correlates of a retroflex lateral than a retroflex rhotic.

We then connected the finding of disyllabic words in Jinzhong and other Shanxi dialects of Mandarin, where the second syllable always begins with [l], proposing that these disyllables, at least a subset of them, are a further development of a pattern similar to that of the Pingding infixation. This entire series of changes of what was originally *er*-suffixation is schematized in (20) below:

(20)   A summary of the development of *l̩*-infixation in Pingding

Stage	Pattern	Notes	Example
1	Er-suffixation		Pekingese
2	Er-suffixation plus allophonic [l] insertion	Conditioning factors of [l] insertion present	Yanggu
3	Er-suffixation vs. *l*-infixation	Conditioning factor lost	Unattested
4	*l̩*-infixation	Leveling	Pingding
5	Fission of *l̩*-infixed words	Hypercorrection	Jinzhong

The origin of Pingding infixation also demonstrates that metathesis need not result in increased perceptibility as proposed in Hume (1997, 1998, 2001) and Steriade (2001). This, along with various recent work on the evolution of metathesis (Blevins and Garrett (1998, in press)) and other sound changes in general (e.g., Kavitskaya (2001), Barnes (2002)), further argues for a perceptual confusion or what Steriade (2001) refers to as the 'innocent' view of sound change.

NOTES

[1] The suffix *-r* (= [ɻ]) often replaces the final C (i.e., nasals) in closed syllables. The direction of merger of rhymes under *er*-suffixation varies quite drastically across dialects and across the ages of speakers (Wang and He 1985). The precise nature of the rhyme mergers does not concern us here. The description given here is typical in most standard descriptions of Mandarin phonology, however.

[2] Chen did not elaborate on what 'antagonistic tongue shapes' refer to specifically and why exactly [i, y, n] are incompatible with [r].

[3] For convenience here we are using the term 'anterior' to refer to the class of sounds that includes the high front vowels and the dental consonants. It should not be taken as a commitment to any particular framework of the featural composition of speech sounds.

[4] It is worth noting here that this acoustic connection between lateral and anterior segments in a low F3 environment (e.g., labial, velar, retroflex, and pharyngeal sounds; the class of sounds characterized by the Jakobsonian feature 'grave') might ultimately underlie the source of a class of sound changes. For example, in the history of the Slavic languages,

Proto-Slavic *labial+palatal glide clusters (*bj, *pj, *vj, *mj), but not the other stop+glide clusters, became *labial+lateral* (bl[j], pl[j], vl[j], ml[j]) in the daughter languages (Carlton (1991, p. 113)).

(i)	Proto-Slavic	*p**j**ŭv 'spit, spew'
	Russian	плевать
	Ukranian	плювати
	Belorus	плявaць
	Slovenian	pl**j**uváti
	Serbo-Croatian	pl**j**ùvati
	Bulgarian	плюя
	Polish	pl**u**ć
	Lowe Lusatian	pl**u**waś

[5] [ɿ] is used here to represent the so-called apical vowel in Mandarin, which is often described as a super-closed high front unrounded vowel.

REFERENCES

Barnes, Jonathan (2002) *Positional Neutralization: A Phonologization Approach to Typological Patterns*, PhD dissertation, University of California, Berkeley.

Baxter, William (1992) *A Handbook of Old Chinese Phonology*, Mouton de Gruyter, Berlin and New York.

Blevins, Juliette and Andrew Garrett (1998) "The Origins of Consonant-vowel Metathesis," *Language* 74(3), 508–556.

Blevins, Juliette and Andrew Garrett (in press) "The Evolution of Metathesis," in B. Hayes, R. Kirchner, and D. Steriade (eds.), *The Phonetic Basis of Phonology*, Cambridge University Press, Cambridge.

Carlton, Terence R. (1991) *Introduction to the Phonological History of the Slavic Languages*, Slavica Publishers, Inc., Columbus.

Chao, Bing Suen (1979) "Jinzhonghua 'Qian l Ci' Hweixi" [l-split Words in the Jinzhong Dialect], *Zhongguo Yuwen* 6, 455–458.

Chao, Yuen Ren (1968) *A Grammar of Spoken Chinese*, University of California Press, Berkeley and Los Angeles.

Chen, Matthew Y. (1992) "The Chameleon [-r] in Yanggu: Morphological Infixation or Phonological Epenthesis?" *Journal of East Asian Linguistics* 1, 197–213.

Dong, Shaoke (1985) "Yanggu fangyan de erhua" [Er-ization in the Yanggu Dialect], *Zhonggua Yuwen* [Chinese Linguistics and Literature] 4, 273–276.

Duanmu, San (2000) *The Phonology of Standard Chinese*, Oxford University Press, Oxford.

Flemming, Edward (1995) *Auditory Features in Phonology*, PhD dissertation, UCLA.

Grammont, Maurice (1909) "Une loi fonétique génerale," *Philologie et linguistique, Mélanges offerts à Louis Havet par ses anciens élèves et ses amis à l'occasion du 60e anniversaire de sa naissance, le 6 janvier 1909*, Hachette, Paris, pp. 179–193.

Hartman, Lawton M. III (1944) "The Segmental Phonemes of the Peiping Dialect," *Language* 20, 28–42.

Hock, Hans Henrich and Brian D. Joseph (1996) *Language History, Language Change, and Language Relationship: An Introduction to Historical and Comparative Linguistics*, Mouton de Gruyter, Berlin.

Hume, Elizabeth (1997) "The Role of Perceptibility in Consonant/consonant Metathesis," in S. Blake, E.-S. Kim, and K. Shahin (eds.), *WCCFL XVII Proceedings*, Stanford, CSLI, pp. 293–307.

Hume, Elizabeth (1998) "Metathesis in Phonological Theory: The Case of Leti," *Lingua* 104, 147–186.

Hume, Elizabeth (2001) "Metathesis: Formal and Functional Considerations," in E. Hume et al. (eds.), *Surface Syllable Structure and Segment Sequencing*, HIL, Leiden, pp. 1–25.

Jurafsky, Daniel (1996) "Universal Tendencies in the Semantics of the Diminutive," *Language* 72(3), 533–578.

Kavitskaya, Darya (2001) *The Phonetics and Phonology of Compensatory Lengthening*, PhD dissertation, University of California, Berkeley.

Li, Charles N. and Sandra A. Thompson (1981) *Mandarin Chinese: A Functional Reference Grammar*, University of California Press, Berkeley.

Li, Fang-kuei (1980) *Shanggu yin yanjiu* [Studies on Old Chinese Pronunciation], Shangwu Yinshuguan, Beijing.

Lin, Yen-Hwei (2002) *Faithfulness, Alignment, and Markedness in Pingding Er Infixation*, ms., Michigan State University.

McCarthy, John J. and Alan Prince (1993) "Generalized Alignment," in G. Booij and J. van Marle (eds.), *Yearbook of Morphology* 1993, Kluwer Academic Publishers, Dordrecht, pp. 79–153.

Ohala, John J. (1993) "The Phonetics of Sound Change," in C. Jones (ed.), *Historical Linguistics: Problems and Perspectives*, Longman, London, pp. 237–278.

Ohala, John J. (1997) "Emergent Stops," in The Linguistic Society of Korea (eds.) *Proceedings of the Seoul International Conference on Linguistics*, Linguistic Society of Korea, Seoul, pp. 84–91.

Potter, Ralph K. et al. (1947) *Visible Speech*, D. Van Nostrand, New York.

Qian, Zengyi, Zhiyun Cao, and Futeng Luo (1985) "Phonetic Differences and Similarities among the Dialects of Pingdu County, Shandong Province," *Fangyan* 3, 214–221.

Ritchie, James A. (1999) "*R* Myth-athesis: A Perception Based Approach at Understanding Some *r*-related Sound Changes," in I. Rauch and G. F. Carr (eds.), *New Insights in Germanic Linguistics I*, Peter Lang, New York, pp. 211–222.

Sagart, Laurent (1999) *The Roots of Old Chinese*, John Benjamins Publishing Company, Amsterdam.

Steriade, Donca (1995) *Licensing Retroflexion*, ms., UCLA.

Steriade, Donca (1997) *Phonetics in Phonology: The Case of Laryngeal Neutralization*, ms., UCLA.

Steriade, Donca (2001) "Directional Asymmetries in Place Assimilation: A Perceptual Account," in E. Hume and K. Johnson (eds.), *Perception in Phonology*, Academic Press, San Diego, pp. 219–250.

Wang, Lijia and Ningji He (1985) "Beijinghua erhuayun de tingbian shiyan he shengxue fenxi" [Discrimination Experiments and Phonetic Analysis of r-rhymes in Beijing], in L. Tao et al. (eds.), *Beijing yuyin shiyanlu* [Experimental Phonetics of Beijing], Beijing University Press, Beijing, pp. 27–72.

West, Paula (1999) "The Extent of Coarticulation: An Acoustic and Articulatory Study," in J. Ohala et al. (eds.), *Proceedings of the XIVth International Congress of Phonetic Science*, San Francisco, pp. 1901–1904.

West, Paula (2000) "Long-distance Coarticulatory Effects of British English /l/ and /r/: An EMA, EPG and Acoustic Study," in *Proceedings, 5th Seminar on Speech Production: Models and Data (SPS 5)*, Kloster Seeon, Bavaria, Germany, pp. 105–108.

Xu, Tongqiang (1981) "Shanxi Pingding fangyan de erhua he Jinzhong suowei de qian l ci" [Er-affixation in Shanxi Pingding Dialect and l-infixation], *Zhongguo Yuwen* XX, 408–415.

Yip, Moira (1992) "Prosodic Morphology in Four Chinese Dialects," *Journal of East Asian Linguistics* 1(1), 1–36.

Yu, Alan C. L. (1999) "Aerodynamic Constraint on Sound Change: The Case of Syllabic
    Sibilants," in J. Ohala, Y. Hasegawa, M. Ohala, D. Granville, and A. Bailey (eds.), *The
    Proceedings of the XIVth International Congress of Phonetic Science*, San Francisco,
    pp. 341–344.

Alan Yu
Department of Linguistics
1010E 59th Street
University of Chicago
Chicago IL 60637
USA
E-mail: aclyu@socrates.berkeley.edu