An Optimality Theory Analysis of Diminutive Suffixation of Beijing Chinese

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ABSTRACT

The common use of retroflex [r] at the end of words in Beijing Chinese to denote a sense of intimacy, casualness and colloquialism has been studied quite extensively using different approaches. It is possible to find this diminutive suffix with all syllable shapes in Beijing Chinese. This paper proposes an OT analysis accounting for the nasal coda changes, vowel deletion, vowel preservation, and vowel insertion in the suffixed form. This analysis avoids assuming the underlying form of the diminutive suffix, a well-debated issue among rule-based analyses. This analysis also answers the questions of why a [+high, -back] vowel is not allowed in front of [r], and why the vowel changes to [ə], not any other vowel. It is noteworthy that the analysis successfully captures the data without referring to the syllable template of Chinese, which is also a controversial topic in Chinese phonology.

Keywords: phonology; diminutive suffixation; Beijing Chinese; Optimality Theory; syllable template; underlying form

1 Introduction

This paper presents a study of diminutive suffixation in Beijing Chinese. An often-used affix in some Chinese dialects is a suffix *–r*. In Chinese it is called *er hua yin*儿化音, meaning 'diminutive suffix'. It gets the name because the suffix is related to a Chinese word *er* [ər] 'son', which has a 'smallness' or 'endearing' meaning. The suffix is used in the spoken language and denotes a sense of intimacy, casualness and colloquialism to the root word. However, there is considerable variation in Chinese dialects with respect to the diminutive suffix. For example, in Shanghai dialect, there is no such suffix at all; in many other dialects that have the diminutive suffix, the suffixed forms exhibit significantly different phonological or even lexical forms (Bao, 1996; Yuan, 1989; Zhang, 2000). This paper, however, will not compare the differences of the diminutive suffixed forms in different dialects, but will focus on the diminutive suffix in Beijing dialect since it is a typical characteristic of Beijing Chinese.

This paper will provide an Optimality Theory (OT) account for Beijing Chinese diminutive suffixation without making an assumption the syllable template and the underlying form of the diminutive suffix. The paper is organized as follows: Section One introduces the Chinese sound inventory and different claims of Chinese syllable templates. Section Two presents data in categories. Section Three reviews literature which addressed the issue of the diminutive suffix. Section Four analyzes the data by using OT constraints and ranking. Section Five concludes the paper with the significance of the OT solution proposed in this paper.

2 Beijing Chinese sound inventory and syllable templates

Beijing Chinese is the basis of Mandarin Chinese, the national lingual franca developed on the northern dialects. Similar to Mandarin Chinese, there are only six phonemic vowels[1] and four possible diphthongs in Beijing Chinese: [ai], [əi], [au] and [əu]. The first two diphthongs end with a [+high, +front] vowel [i], while the next two diphthongs end with a [+high, -front] vowel [u].

Table 1
Beijing Chinese vowel inventory

	Front		Central	Back	
	unround	round		unround	round
High	i	y	(ɨ)		u
Mid	(e)		(ə)	ɤ	o
Low			a		

The following is the Beijing Chinese consonant inventory.

Table 2
Beijing Chinese consonant inventory

		Labial	Dental	Retroflex	Palatal	Velar
Stop	[+asp]	p^h	t^h			k^h
	[-asp]	p	t			k
Affricate	[+asp]		ts^h	$ʈʂ^h$	($tɕ^h$)	
	[-asp]		ts	ʈʂ	(tɕ)	
Fricative		f	s	ʂ	(ɕ)	x
Nasal		m	n			ŋ
Liquid			l	r		

A characteristic of Beijing Chinese is the common use of retroflex [r] at the end of words. The diminutive suffix in Mandarin adopts the diminutive suffixation system of Beijing Chinese, rather than that of other northern dialects. Although the occurrence of the suffix is related to some sociolinguistic factors, which are not discussed in this paper, it is possible to find the diminutive forms with all the syllable shapes in Beijing Chinese.

[1] There are three additional vowels, i.e., [ɨ], [e], and [ə], appearing in restricted contexts in the surface forms. [e] appears only after a consonantal equivalent of a [+high, +front] vowel, i.e., [ɥe] "moon"; [ɨ] only with so called "syllabic consonants", i.e., [ʐɨ] "character"; and [ə] in diphthongs or retroflexed sounds.

In addition to [r] at coda position, Beijing Chinese, same as most Chinese dialects, also allows two nasals at coda positions, [n] and [ŋ]. Therefore, the syllable structure of Beijing Chinese is (O)V{(n), (ŋ), (r)}. I avoid using C at onset position because of a big debate on whether there is a glide after an onset consonant (for example, Bao, 1996; Lin, 2001), or there is only a secondary articulation to the onset consonant (for example, Duanmu, 1993, 2000; Yin, 1989). Since the syllable template is not the focus of this analysis, we will not consider the variation of onsets in the IPA transcriptions.

3 Data

There is variation in terms of Chinese IPA transcriptions; that is, different phonologists transcribed Chinese words into different IPA forms. The main reason is that there is disagreement regarding Chinese syllable structure. Despite that, we can roughly categorize the suffixed forms into six types. The data used in this paper are based on Duanmu (2000) and Yin (1989), and many are added to make it a complete data set.

1) The first group consists of six onset consonants that include the three dental consonants and three alveo-palatal consonants in Chinese.

(1)		*Root*	*Diminutive Form*	*Gloss*
	a.	tsz̩ / tsɨ	tsər	'character'
	b.	ts^hz̩ / ts^hɨ	ts^hər	'lyrics'
	c.	sz̩ / sɨ	sər	'silk'
	d.	tʂr̩ / tʂɨ	tʂər	'twig'
	e.	$tʂ^h$r̩ / $tʂ^h$ɨ	$tʂ^h$ər	'tooth'
	f	ʂr̩ / ʂɨ	ʂər	'thing'

As is seen, the transcription of the nucleus is different in the root forms, but the diminutive forms are the same. The root forms are transcribed with a syllabic consonant [z̩] or [r̩] in the peak position of a syllable by Duanmu (2000), or with a high central vowel [ɨ] in the peak position by Yin (1989). However, there is agreed transcription of the suffixed forms. The diminutive forms end with [ər] suffixation, while either the syllabic consonant or the vowel is deleted. The variation in the root transcriptions might be due to personal difference.In this paper, I will use the second IPA form of each root form as the input in the OT analysis.

2) In a second group, the roots end with diphthongs where the second component is [+high, +front] vowels. In the diminutive forms, the [+high, +front] vowels are deleted. When the root is a monophthong, [ər] is added and the vowel becomes a glide; when there is a diphthong in the root, the vowel before [+high, +front] is preserved, and only a suffix [r] is added.

(2)		*Root*	*Diminutive Form*	*Gloss*
	a.	p^hai	p^har	'plate'
	b.	pəi	pər	'tablet'
	c.	tɕi	tɕjər / $tɕ^j$ər	'chicken'

d.	ɥy	ɥər	'fish'

In (2c) diminutive form there are two different transcriptions which are from the following sources: [tɕjər] from Gick and Wilson (2003), and Lin (2001), and [tɕʲər] from Duanmu (2000), Ma (1997) and Yin (1989). Again, the existence of two different transcriptions might be due to speaker's variation, or might be different opinions on Chinese syllable structures. The paper will not touch on the debate of the onset of Chinese syllable template. Therefore, in the OT analysis of (2c), we will treat the two transcriptions the same.

3) Another group of words preserve the identical vowels of the root forms, and simply add an [r] at the end of the word in the diminutive forms. As we can see, this group consists of a complete vowel inventory other than [+high, -back] vowels, i.e., [i, y, ɨ], and a mid vowel [ə]. This group also includes two diphthongs which do not end with a [+high, -back] vowel. The mid vowel [ə] in Chinese is only combined with [r], and it will be discussed later.

(3)	*Root*	*Diminutive Form*	*Gloss*
a.	hu	hur	'lake'
b.	wo	wor	'nest'
c.	ɥe	ɥer	'moon'
d.	kɤ	kɤr	'song'
e.	pa	par	'handle'
f.	tau	taur	'knife'
g.	kəu	kəur	'hook'

4) There are only three vowels that can take [n] in coda position in a root. In the diminutive forms coda [n] in the roots is deleted and [r] is added. As for the vowels, there is no change for the non [+high, -back] vowels in the diminutive forms, (4a, b) for example, but the [+high, -back] vowel in the root changes to schwa [ə] in the suffixed form, (4c) for example, which is the same as the regular vowel alternations in (2).[2]

(4)	*Root*	*Diminutive Form*	*Gloss*
a.	pʰan	pʰar	'dish'
b.	kən	kər	'root'
c.	tɕin	tɕjər / tɕʲər	'today'

5) There are three vowels that can take [ŋ] in coda position in a root. This nasal coda is preserved in the diminutive form and the diminutive suffix [r] is added at the end of the word.

(5)	*Root*	*Diminutive Form*	*Gloss*
a.	kaŋ	kaŋr	'jar'
b.	təŋ	təŋr	'lamp'
c.	kʰuŋ	kʰuŋr	'free time'

[2] The variation in terms of the transcription of diminutive forms of (4c) follows the same pattern as (2c). They are not differentiated in this analysis.

6) The last group only has one sound, although there is tonal variation. The root itself ends with [r], and there is no change in the suffixed form.

(6)		*Root*	*Diminutive Form*	*Gloss*
	a.	ər	ər	'son'/ 'ear'/ 'two'

4 Previous Analyses

Diminutive suffix has been studied quite extensively by different approaches. Some of them focus on the description of transcriptions (e.g., Bao, 1996; Chao, 1968); some focus on rule-based analyses (e.g., Duanmu, 1990, 2000; Lin, 1989; Yin, 1989; Wang, 1993). Only a few provided OT analyses with different focuses (Feng, 2002; Ma, 1997, 1998; Zhang, 2000). This section will then review three rule-based analyses, and discuss the focuses of the other OT analyses on this issue.

4.1 Rule-based analyses

This subsection will review three analyses, from which we can generalize some problems in the rule-based analysis of the diminutive suffixation.

Lin (1989) treats the suffix as a segment [r], and [r] is added to the root form and merged into one syllable in four steps.

(a) Replace the coda with [r] or add [r] if there is no coda in the root.

(b) Reattach the replaced coda to the nucleus if the coda is [+back].

(c) Delete unattached sounds.

(d) Add [ə] between a front high vowel and [r].

In this analysis, the second vowel of a diphthong is treated as a coda, and replaced by [r] at the first step, which is not consistent with most phonological analyses that treat vowels as the peak of a syllable and only consonants as coda. Secondly, deletion of [-back] codas including [n] and [i] lacks motivation; especially, [n] has a perceptually salient feature of [+nasal]. Thirdly, it is not motivated why there is a schwa insertion between a front high vowel and the suffix, not any other kind of vowel insertion.

Duanmu (1990) emphasizes feature compatibility and argues that the suffixation is completed in three steps.

(a) Replace the coda of the syllable with [r].

(b) Reattach any compatible features.

(c) Delete unattached features that do not surface.

Duanmu claims that in diphthongs [ai] and [əi], [i] has a [-retroflex] feature, while [r] has a [+retroflex] feature, so this is why the [i] in a diphthong is deleted. In [au] and [əu], [u] is [+round], but [r] is unspecified for this feature, so this explains why [u] in a diphthong is preserved. Although there is a motivation for the change of a diphthong, it is still unclear why the second segment in a diphthong should be treated as a coda in the same way as nasal codas. In addition, this analysis fails to capture why the nasal [n] is deleted, while [ŋ] is saved in the suffixed form. Another problem of this analysis is that [i] in a monophthong is simply followed by [r] even though they have incompatible features, which is the motivation used to delete an incompatible segment in a diphthong. Nothing about schwa insertion is mentioned in the analysis, but it exists in the diminutive forms.

In his latest analysis, Duanmu (2000) proposes that all standard Chinese full syllables have the structure CVX, with one onset slot and two rhyme slots. The pre-nucleus glides [j, w, y] is assigned to the onset as a secondary articulation, i.e., C^G. The second rhyme slot can be a nasal coda or a second segment of a diphthong. In terms of suffixation, [r] is specified for [+retroflex] under Coronal. When added to a root, it is incompatible with other segments which also have Coronal features, including [i, y, n]. The other vowels and [ŋ] do not have Coronal feature, so they are compatible with [r] and are preserved in the suffixed form. This analysis assumes three steps as well:

(a) When a sound is incompatible with [r], the sound is replaced. Otherwise [r] is added to the sound as a secondary articulation.

(b) Rhyme segments cannot differ in [retroflex]

(c) Mid: the default height of the nucleus is mid.

A problem in this analysis concerns the syllable template proposed. If there are two timing slots in the rhyme, as the analysis assumes, [r] suffix should take the second rhyme slot rather than becoming a secondary articulation of the monophthonic vowel. Besides, in the analysis, rather than being replaced, the monophthonic [+high] vowels are preserved and allow [r] to take the second rhyme slot, which is contrary to what is assumed in Step One, which suggests when two segments are incompatible, the first sound should be replaced. Analysis in this way paves the way for his second step that the [+high] vowels change to [-vocalic] consonants [j] or [g]. And then this allows a mid vowel insertion as in Step Three. If the suffix does not take the second time slot in the first step, what is assumed in the second and the third steps cannot be achieved. So this analysis can not satisfactorily explain why [+high] vowel in a diphthong is deleted, but preserved in a monophthong.

To sum up the above three analyses, we can see that most rule-based analysis fail to answer the following questions:

(1) Why is [n] deleted, but [ŋ] is saved in the suffixed forms?

(2) Why is the inserted vowel always a schwa, not any other vowel?

(3) Why is monophthong [i] preserved, but [i] in a diphthong [Vi] not?

(4) Since there is not an agreed syllable template in Chinese, is there any other solution to capture the diminutive suffixation without referring the template?

4.2 Other OT analyses

There are only three researchers looking into the diminutive suffix in Chinese within the framework of OT, as far as I can find. Feng (2002) focuses on a Mandarin dialect spoken in Anxiang in Hunan Province in central China. In this dialect, the diminutive form is similar to a reduplication of a root with the second syllable ending with [r]. For example, the diminutive form of [ke] is [ke.kər] 'square'. What Feng proposes is that the diminutive form is still a suffixation, not a reduplication by introducing Anchoring constraints. She proposes that the suffix in Anxiang Chinese is the same as the suffix in other dialects, i.e., [r] suffix. However, the data and the discussion in this paper are very different from the topic of this paper – Beijing Chinese. We need to see if an OT solution can account for Beijing Chinese.

Zhang (2000) focuses on whether it is a MAX constraint or an IDENT constraint that selects the optimal candidate through discussing the nasal codas in four Mandarin dialects. The results show that although both constraints work for Beijing Chinese, only MAX constraints are attested cross-dialectically. He therefore argues that the right constraints to be used should be Max constraints with respect of the diminutive suffix in Chinese. A question left unanswered is how OT captures the whole picture of the diminutive suffixation, such as the changes to vowels, in addition to the nasal changes.

Ma (1997, 1998) studies the diminutive suffix in Chinese, relying on the syllable template proposed by Duanmu (1990, 1993). So, some of the constraints proposed are template oriented. For example, in her analysis such constraints are used:

Nucleus/V:	A higher sonority nucleus is more harmonic than one of lower sonority when two are competing for one slot.
Spread(labial):	Labials must spread to a nearby consonant: front vowel to onset; back vowel to coda.

Such constraints work for her data with reference to Duanmu's syllable template. But since there is no agreed opinion on Chinese templates so far, it will be better if there is an OT solution which does not need to refer to any template but captures the data.

Thus, the objective of this paper is to propose an OT solution which can account for the data without referring to syllable template. The solution should be able to capture the [n] and [ŋ] variation, the schwa vowel insertion, deletion of some vowels versus preservation of the other vowels, etc.

5 OT analysis

In this section, we will first decide what the underlying form of the diminutive suffix of Beijing Chinese is, and then move to a detailed OT analysis of the diminutive forms.

5.1 Diminutive Suffix

There is no agreed form of the Mandarin diminutive yet. Lin (2001) describes it as a feature [retroflex], not a segment, but she did not discuss the reason. Some phonologists argue that the underlying form is /r/, (Chao, 1968; Duanmu, 1990, 2000), while others prefer /ər/ (Cheng, 1973; Yin, 1989). These phonologists adopt different derivational rules, but their explanations are not satisfactory. The former view does not capture why the inserted vowel is a schwa, not other vowels, such as data sets (1) and (2); while the latter view fails to explain why the schwa is deleted in some other cases, such as in data sets (3) to (5) (Ma, 1997, 1998). However, using the OT analysis, we can discuss the diminutive forms without running into such a problem. The choice of input in OT analysis is not so important compared to correctly choosing underlying forms in derivational analyses. In OT, constraints will conspire to select an optimal candidate, which is the attested form. Therefore, in our following OT analysis, we will not refer the diminutive suffix to either /r/ or /ər/; rather, we will simply use DIM to stand for the diminutive suffix. As we will see in the later analysis, this assumption will not cause any problem; thus, it will solve the conflict of other phonology assumptions.

5.2 OT analysis

In Beijing Chinese, the diminutive suffix always surfaces in the attested forms, and it always follows the root form. These two facts can be achieved by two undominated constraints, the ranking of which does not matter:

RMORPH:	A morpheme must be phonologically realized in the output.
ALIGNR(AFFIX, R, PRWD, R)	The right edge of the affix has to align to the right edge of the prosodic word.

Tableau 1
The effect of constraints of RMORPH and ALIGNR

	/pa-DIM/	RMorph	AlignR
	pa	*!	
☞	par		
	ra		*!
	ər.pa		*!*

Another fact is that the suffixed form is always a monosyllabic word instead of disyllabic, which is very likely due to the fact that all Chinese words are monosyllabic. This fact can be achieved by a markedness constraint, and this constraint should be ranked really high as well. The effect of this constraint will be illustrated later.

*STRUC-σ: Do not have syllables.

In data sets (3) to (5), all the vowels which are not [+high, -back] are preserved in the diminutive forms. So we will assume that in the attested forms, the vowel keeps the same as the ones in the roots. The fact that the [+high, -back] vowels change to schwa will be left for discussion next. So, we need a faithfulness constraint. The suffixation is an output-output correspondence in that the input is the base and the suffix morpheme and the attested output is the affixed form. So the faithfulness constraint we need is a Base to Affixed form correspondence.

MAX-BA: Every element of base must have a correspondence in the affixed form.

So far, the ranking between *STRUC-σ and MAX-BA does not seem to matter.

Tableau 2
The effect of constraints of *STRUC-σ and MAX-BA

	/pa-DIM/	*STRUC-σ	MAX-BA
	pa.ər	**!	
☞	par	*	
	pər	*	*!a

Because the MAX-BA constraint restricts that every element of the base must have a correspondence in the affixed form, any change to the vowels will violate this constraint. The realization of the diminutive suffix as either [r] or [ər] does not violate this MAX-BA constraint since this is a constraint for the base and affixed form, not a constraint for the suffix. Besides, we do not treat the suffix as an element, but a morpheme in this analysis.

Now, let's look at the case of [+high, -back] monophthong vowels. In all the diminutive forms, [+high, -back] vowels are deleted, including [i, y, ɨ], and a schwa takes the place. By measuring the speech of three native speakers of Beijing Chinese, Gick and Wilson (2003) confirmed Pulleyblank's (2003) claim that there should be a schwa between an advanced tongue root (ATR) vowel and a postvocalic position [r]. The reason is that the transition of tongue root or dorsum retraction is a schwa-like configuration (Gick & Wilson, 2003, p.17). However, this assumption fails to explain two facts in the suffixation in Beijing Chinese.

First, another ATR vowel [e], when followed by a postvocalic [r], does not take a schwa in between. On the contrary, a high central vowel that is not an ATR vowel [ɨ] is deleted and a schwa takes the place. So I assume that the transition of tongue root or dorsum retraction is not between an ATR vowel and [r], but is between a [+high, -back] vowel and a postvocalic [r]. That is to say, the height and frontness of a vowel, rather than advanced tongue root, influences the transition between a vowel and a postvocalic [r], the tongue position of which is not so much low as back vowels. This assumption may need more experimental support and will be studied in the future. This phonetic assumption can be captured by a markedness constraint:

*$V_{[+high,-back]}$r: No [+high, -back] vowel before [r].

There are three possible solutions to avoid a [+high, -back] vowel immediately preceding postvocalic [r]: to delete the vowel, to delete [r], or to add a vowel between the vowel and the consonant. As we have already discussed, all the attested diminutive forms in Beijing Chinese end with [r], and we have a constraint RMORPH to make sure that it will be preserved. So the first possible solution does not apply. If we deleted the vowel, we would expect to see an unattested form *[tɕr] for [tɕi] 'chicken' for example. Besides, this candidate also violates a constraint we discussed already: MAX-BA, which requires the vowel in the base be preserved in the output. So the second solution does not work either. When we consider the third solution, we can see in the attested forms, there is always a vowel insertion and the inserted vowel is always a schwa, a vowel unspecified for place cross-linguistically. Inserting any other full vowel is not grammatical. So, a markedness constraint is needed.

*PlaceV: A vowel should not have a place feature.

This constraint has to be ranked low because all the non [+high, -back] vowels are preserved in the affixed forms.

Tableau 3
The wrong ranking of constraints of *PLACEV and MAX-BA

/pa-DIM/	*PLACEV	MAX-BA
par	*!a	
❽ pər		*

Therefore, when interacting with the previously discussed four constraints, the six constraints have to be crucially ranked. The MAX-BA constraint has to be ranked lower than the others in order to preserve only one full vowel in a diphthong ending with a [+high, +front] vowel, and the *PlaceV constraint has to be ranked the lowest in order have schwa insertion. The crucial ranking like this will not affect a non [+high, +front] vowel. As we saw in Tableau 2, the constraints can toss out the unattested forms when they are not crucially ranked. So, the constraints should be able to toss out the unattested forms as well when crucially ranked.

For cases of [+high, -back] vowels, without such crucial ranking, the attested form for a diphthong would be tossed out. For example, the attested form of [p^hai] 'plate' with suffix is [p^har], which violates MAX-BA, but *[p^hair] does not violate this constraint, although it violates another constraint *V$_{[+high,-back]}$r. In order for the attested candidate to win, the MAX-BA constraint has to be ranked low. So, the crucial ranking is as follows:

RMORPH, ALIGNR(SUFFIX, R, PRWD, R), *V$_{[+high,-back]}$r, *STRUC-σ >> MAX-BA >> *PLACEV

The following tableau illustrates the ranking of the constraints so far by using two words. One ends with a [+high, -back] vowel: [tɕi] → [tɕjər], ‘small chicken’, and the other ends with a diphthong which also has a [+high, -back] vowel: [p^hai] → [p^har], ‘plate’. For the sake of simplicity, we will not include the constraints of RMORPH and ALIGNR, and all the candidates violating the two constraints will not be included either.

Tableau 4
Change of [+high, -back] vowels in Beijing Chinese diminutive forms

/ʃi- DIM/	*V$_{[+high,-back]}$r	*STRUC-σ	MAX-BA	*PLACEV
ʃir	*!	*		*
ʃi.ər		**!		*
ʃər		*	*!	
☞ ʃjər		*		
ʃjar		*		*!
ʃr		*	*!	
/p^hai – DIM/				
p^hair	*!	*		**
p^hai.ər		**!		**
p^ha.ər		**!	*	*
☞ p^har		*	*	*
p^h ər		*	**!	
p^h r		*	**!	

In the case of a diphthong, if only one vowel is deleted, there is one violation of MAX-BA constraint. If both vowels are deleted, there are two violations. That is how the unattested form *[p^hər] is tossed out and the attested form [p^har] wins, although both of them are well-formed syllable types. In the case of deleting a [+high, -back] vowel and inserting a vowel to have a well-formed syllable, another full vowel can never take the place since it violates the *PLACEV constraint. However, when there is a non [+high, -back] vowel in the root, schwa can never take the place because of the higher ranking of the MAX-BA constraint over the *PLACEV constraint, which is illustrated by (3e) again.

Tableau 5
Full vowels in the root in Beijing Chinese diminutive forms

/pa- DIM/	MAX-BA	*PLACEV
☞ par		*
pər	*!	

Next, we will deal with the nasal coda problems in Beijing Chinese diminutive forms. As we have seen in Section Two, all the [n] codas are deleted in the diminutive forms in data set (4), while all the [ŋ] codas are preserved at coda position in data set (5). According to

Duanmu (2000), [r] is specified for [+retroflex] which is under Coronal. Nasal [n] also has a coronal feature, while [ŋ] does not. Since [ŋ] and [r] are incompatible, they are perceptually more salient. Zhang's (2000) experimental study found that the overall glottal flow is greater in the context of /C_ ŋ / than in that of /C_n/, which means that the nasality induced by the [ŋ] is perceptually more salient than the nasality induced by [n] as well. Both analyses support that we need a constraint which requires the preservation of the nasality of /ŋ/, not /n/. This constraint should be ranked really high. Therefore, we have a faithfulness constraint to preserve the [ŋ] feature of the root in the diminutive form.

MAX-IO[ŋ]: A feature [ŋ] of the input must have a correspondent in the output.

Two other related constraints are needed. In the attested forms, there are no consonant clusters in the coda position except for [ŋr], so there is a constraint to restrict the complex codas, and this constraint should be ranked relatively low, but not the lowest in order to toss out [nr], but preserve [ŋr]. There are no nasalized vowels in Beijing Chinese, so there is a markedness constraint, and this constraint should be ranked high since there is never such a case in the attested form.

*VNASAL: Vowels can not be nasals.
*COMPLEXCODA: No consonant clusters are allowed in coda position.

The crucial ranking between these constraints with the previous discussed constraints should be as follows:

RMORPH, ALIGNR(SUFFIX, R, PRWD, R), *$V_{[+high,-back]}$r, *STRUC-σ, MAX-IO[ŋ], *VNASAL >> *COMPLEXCODA >> MAX-BA >> *PLACEV

For the same reason of simplicity, the RMORPH, ALIGNR, *PLACEV and *$V_{[+high,-back]}$r constraints are not included in the illustrative tableau below.

Tableau 6
Nasal codas with diminutive suffix in Beijing Chinese

/pan–DIM/	*STRUC-σ	MAX-IO[ŋ]	*VNASAL	*COMPLEXCODA	MAX-BA
panr	*			*!	
pan.ər	**!				
pa.ər	**!				*
☞ par	*				*
pãr	*		*!		
pər	*				**!
/taŋ – DIM/	*STRUC-σ	MAX-IO[ŋ]	*VNASAL	*COMPLEXCODA	MAX-BA
☞ taŋr	*			*	
taŋ.ər	**!				
ta.ər	**!	*			*
tar	*	*!			*
tãr	*		*!		
tər	*	*!			**

As illustrated in the above tableau, *COMPLEXCODA has to outrank MAX-BA in order to toss out *[panr] and allow the attested form [par] to win, in which [n] is deleted to avoid a complex coda. Because of the undominated MAX-BA[ŋ] constraint, [taŋr] wins although it violates the lower ranked *COMPLEXCODA constraint.

Some phonologists claim that there is no [taŋr], but [tãŋr], but in this paper, we argue that the vowel is nasalized for a phonetic reason because it is in a nasal environment. The nasalized vowel is universally dispreferred. A speaker can predict a vowel to be nasalized when a nasal is present. So, we will still keep the attested form as [taŋr], not *[tãŋr].

The last problem is the diminutive form of a word which is the same as the diminutive suffix. Using our current constraints and crucial ranking, we can successfully capture this data.

Tableau 7
Diminutive suffixed form in Beijing Chinese

/ər–DIM/	*STRUC-σ	RMORPH	ALIGHR	*COMPLEXCODA	MAX-BA
[ərr]	*			*!	
[rər]	*		*!		
[ər.ər]	**!				
$[\text{ər}]_1$	*	*!			
☞ $[\text{ər}]_{1,2}$	*				

Both candidates $[\text{ər}]_{1,2}$ and$[\text{ər}]_1$ are the same phonetically as the attested form. Our analysis selects $[\text{ər}]_{1,2}$ as the optimal candidate because both morphemes are realized in $[\text{ər}]_{1,2}$ and they are overlapped.

6 Conclusion

This paper has proposed a set of constraints and a crucial ranking to analyze the data and data sets in Beijing Chinese. It is noteworthy that the analysis avoids the conflict as for what is the underlying form of the diminutive suffix, a point not agreed upon by some phonologists. It also successfully captures the data without referring to the syllable template of Chinese, a controversial topic in Chinese phonology as well. The constraints we used in this analysis are summarized as follows:

Markedness Constraints:

*VNASAL:	Vowels can not be nasals.
*COMPLEXCODA:	No consonant clusters are allowed in coda position.
$*\text{V}_{[+\text{high},-\text{back}]}\text{r}$:	No [+high, -back] vowel before [r].
*STRUC-σ:	Do not have syllables.
ALIGNR(AFFIX, R, PRWD, R)	The right edge of the affix has to align to the right edge of the prosodic word.
*PlaceV:	A vowel should not have a place feature.

Faithfulness Constraints

RMORPH:	A morpheme must be phonologically realized in the output.
MAX-IO[ŋ]:	A feature [ŋ] of the input must have a correspondent in the affixed form.

MAX-BA: Every element of the base must have a correspondence in the affixed form.

As is seen, this set of conspiring constraints select the 'optimal' candidate and the analysis captures the change of the diminutive forms in Beijing dialect without referring the syllable template, on which there is still a debate. The arguments between different phonologists are not conflicts any more by using the above analysis. The markedness constraints used in this analysis are all cross-linguistic dispreferences, which also supports the universality of OT.

The argument of what is the underlying form of the diminutive suffix is not a necessary discussion in the OT analysis. As we can see, this analysis did not assume the underlying form as either /r/ or /ər/, and it successfully selects the attested forms. Besides, this analysis also answers questions as when a [+high, -back] vowel is disallowed in front of [r], and why the vowel changes to [ə], not any other vowel. The change to schwa is also a universal preference of an unmarked form – the emergence of the unmarked (TETU) (McCarthy & Prince, 1994; cited in Kager, 1999, p. 198). In general, the OT analysis provides a satisfactory solution to the diminutive suffixation of Beijing Chinese.

Comparing with the other OT analyses mentioned in Section 1.3, this analysis does not refer to the syllable template; which is different from Ma's (1997, 1998) analyses. It is thus more convincing, especially because there is not an agreed syllable template in Chinese yet. This OT analysis also captures the changes of nasal codas, vowel deletion, vowel preservation, and vowel insertion, unlike Zhang's (2000) study, which only focuses on the nasal codas, although his study focuses on a cross-linguistic fact, rather than a particular language. In this sense, this OT solution is more comprehensive.

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