Chapter Four

TONE NEUTRALIZATION, SANDHI SUSPENSION AND SELECTION

Previous chapters were devoted to expounding the tenets of inter-tier correspondence theory (ICT) and its usefulness in dealing with phenomena typically understood as iterative application of a set of rules. Nonetheless, a few questions remained unaddressed. Firstly, there is some need to compare the two main languages discussed (Mandarin and Tianjin), since tone sandhi in both languages are triggered by the OCP, with faithfulness to the identity of the right-edged tone. Chapters Two and Three assume that these languages are right-headed, thence the stability of the right-edged tone under sandhi. It remains to be seen if this position is viable when taking into consideration the fact that tone neutralization happens to the rightmost syllable (see Chapter Two, on Mandarin neutral tones).

Secondly, Tianjin absorption clearly applies after dissimilation tone sandhi and applies in a once-and-for-all manner, which is acyclic. Why would Tianjin tolerate apparently marked environments manufactured by absorption? Finally, there is the matter on the selection of tones. The preceding chapters have not provided any account on how a given tone is mapped to another under alternation. Specifically, why did T3 $\rightarrow$ T2 in Mandarin, why did F $\rightarrow$ L, L $\rightarrow$ R and R $\rightarrow$ H in Tianjin dissimilation, but F $\rightarrow$ H and R $\rightarrow$ L in Tianjin absorption? This chapter shall be devoted to these residual questions. Section 4.1 begins with an explanation of Mandarin neutralization's compatibility with prosodic right-headedness, assuming that neutralization is triggered by suffixation. Section 4.2 goes on to support the right-headedness assumption by citing the parallels
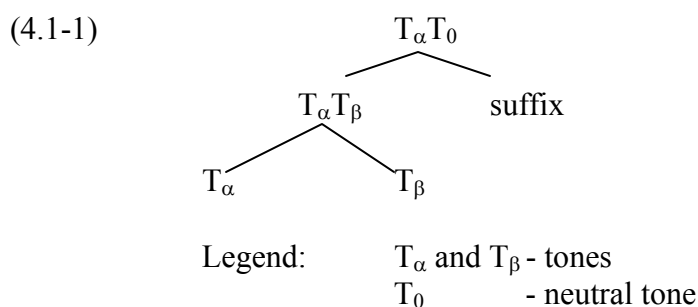
between Tianjin and Mandarin tone sandhi rules. Section 4.3 accounts for why Tianjin tolerates marked collocations generated by absorption by appeal to phonetic evidence that the sandhi triggering collocation is only apparent. Section 4.4 is a treatment of tone selection in Tianjin and Mandarin, essentially explaining that adjacency of identical tones is what prompts the mapping between underlying tones and sandhied ones. Section 4.5 appeals to the compatibility of comparative markedness theory and inter-tier correspondence so as to expand the account of tone selection to include larger structures. Section 4.6 explains that the Mandarin third tone, whether construed as low or dipping, requires no further assumptions because under both conceptions do sandhi application do not generate adjacent identical tone features. The chapter ends with a summary.

4.1.   Mandarin neutralization

Recall that INTF-HD (with the further assumption that Mandarin and Tianjin are right-headed) was postulated in Chapter Two so that the stability of the final tone in Mandarin tone sandhi may be expressed. Apparently, a more direct approach might have simply been to assume a constraint such as INTF-R(ight) so that the rightmost element must percolate faithfully. The discomfort of postulating INTF-R, especially in the light of Nelson (1998), is that faithfulness to the rightmost element should be reduced to faithfulness to a head position. In fact, Nelson argues that constraints such as ANCHOR RIGHT (which in effect is the same as positional faithfulness to the rightmost element) is (i) not widely attested in reduplicated and/or truncated forms, (ii) pathological in predictions in that it would wrongly allow for a system that "anchors to the right edge of the base rather than to the stressed syllable, when the two qualities are not compatible"

and (iii) unnecessary because effects of this constraint is attributable to other independently motivated constraints such as anchoring to the prosodic head.

This section argues that neutralization of the tone on the right edge can remain compatible with a right-headedness assumption. The essential idea is that neutralization on the rightmost tone happens because of suffixation of a tone reducing morpheme. This is illustrated in the following diagram.

(4.1-1)
$$
\begin{array}{c}
T_\alpha T_0 \\
\swarrow \quad \searrow \\
T_\alpha T_\beta \qquad \text{suffix} \\
\swarrow \quad \searrow \\
T_\alpha \qquad T_\beta
\end{array}
$$

Legend: T_α and T_β - tones
T_0 - neutral tone

The main idea in (4.1-1) is that if suffixation of a tone neutralizing morpheme happens at the root node, then tone sandhi may take place at lower nodes. This will produce the counterbleeding ordering effect found in the interaction between Mandarin tone sandhi and neutralization. Treatments along the lines of (4.1-1) allow for right-headedness (in this case T_β) that eventually gets neutralized (especially with CT COND, cf. Chapter 3: (3.5-11)).

If T_β is the head, then given a situation such as (4.1-1) where there is a tone reducing suffix, it would appear on the surface that the head is neutralized. I suspect it is this that is the cause for the controversy between whether Mandarin is prosodically right-headed or left-headed. Since the main thrust of the left-headed argument lies in neutralization, accounts along (4.1-1) resolves that controversy in favor of the right-

headed camp. The appeal behind (4.1-1) is that the null suffix would have little bearing on the prosody (because it is null), but yet the interleaving between morphology and phonology would produce exactly the effect of the prosodic head appearing to be neutralized.

The crux of the challenge that underlies Mandarin neutralization is the combination of two things - firstly, the counterbleeding order of tone sandhi application prior to neutralization and secondly, the absence of tone sandhi under some cases. To refresh our memories, here are the key examples, repeated from Chapter 2: section 2.

(4.1-2) With tone sandhi

    a.   i. da2shou3 /da3shou3/ 'hit hand'   verb phrase

          ii. da2shou0   'bouncer, fighter'   noun

    b.   i. zou2zou3 /zou3zou3/ 'walk (emphatic)'

          ii. zou2zou0   'take a short walk'

(4.1-3) Without tone sandhi

    a.   jie3jie0   'sister'

    b.   nai3nai0   'granny'

    c.   bao3bao0   'baby'

    d.   gou3gou0   'doggie'

The most evident question in view of the above data is why tone sandhi occurs in (4.1-2) but not (4.1-3). A straightforward reply would be that in the reduplication of familiar terms such as (4.1-3), tones are not copied, thereby having no sandhi-triggering

environment. As far as I can tell, this generalization appears to be correct and I shall state it as follows.

(4.1-4) Generalization on Mandarin familiar reduplication

Reduplication of familiar/familial terms in Mandarin does not involve copying of the base tone.

With (4.1-4), the neutral tones in (4.1-3) are really not the result of neutralizing an existent tone. The rightmost tone is in this case not there to begin with as it is not copied from the base. The next question would be how to capture the counterbleeding ordering effect in (4.1-2). After all, neutralization does bleed the sandhi-triggering environment by removing the T3 on the right. The solution to this is (4.1-1). Neutralization is assumed to be the result of suffixation of a tone reducing morpheme. Within the inter-tier correspondence framework, this would be perfectly compatible with a right-headed assumption. The following diagram exemplifies this.

(4.1-5)   da2shou0   'bouncer/fighter'

              da2shou3   tone reducing suffix

        da3   shou3
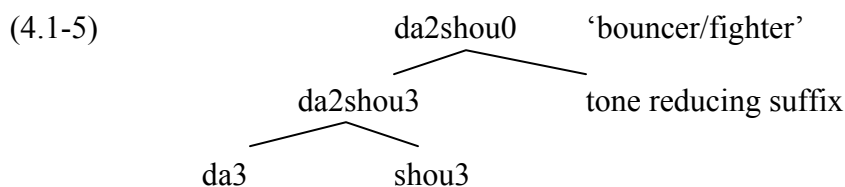
(4.1-5) shows how within ICT, the counterbleeding effect can be effectively captured by the same mechanism that accounted for the counterbleeding effect of left branching T3 sequences (cf. Chapter Two). All that remains is to see if there is any independent reason to believe that a tone reducing suffix is indeed present or if that

assumption is merely a matter of convenience so that Mandarin may be assumed to be prosodically right-headed.

Examples like da2shou3 'bouncer/fighter' suggest that there is some affixation of a null morpheme that lexicalizes what is otherwise a verb phrase. In fact, when one consults the list of examples cited as neutralization, it becomes clearer that some morphological processes are at work. Below is a sample list, repeated from Chapter Two (2.1-7).

(4.1-6) Examples of neutralization (data from Zhang 1977)

a.	i. sheng1xing4	'nature of character'		noun
	ii. sheng1xing0	'untamed'		adjective
b.	i. zhang4ren2	'sir'		noun
	ii. zhang4ren0	'father-in-law'		noun
c.	i. di3xia4	'underneath'		adjective
	ii. di3xia0	'underneath'		noun
d.	i. gao4shi4	'relate, tell, proclaim'		verb
	ii. gao4shi0	'notice, proclamation'		noun
e.	i. da2shou3 /da3shou3/ 'hit hand'			verb phrase
	ii. da2shou0	'bouncer, fighter'		noun

Notice that with the exception of (4.1-6b), all of them involve a change in syntactic category, something typical of morphological processes. As such, it does seem rather reasonable to assume that there is a null morpheme suffix, without which one

might be at a loss on providing an account to the relation between each data pair in (4.1-6).

Neutralization is just about the only problem a right-headedness approach faces. If it may be granted that neutralization is nothing other than a stem reducing suffix, controversy over the locus of the Mandarin prosodic head becomes less messy.

4.2. Comparing Mandarin and Tianjin

If neutralization in Mandarin may be accounted for with a segmentally null suffix that reduces the tone of the stem, then the position that Mandarin is prosodically right-headed becomes plausible. With reference to Tianjin, right-headedness in Mandarin has an additional advantage. To begin this exploration, the relevant Tianjin tone sandhi rules are repeated below.

(4.2-1) Alternation by identity (dissimilation)

  a. L → R / __ L

  b. R → H / __ R

  c. F → L / __ F

Notice that (4.2-1a) is very similar to the Mandarin tone sandhi rule, given below.

(4.2-2) Mandarin tone sandhi

L → R / __ L (more commonly written as T3 → T2 / __ T3, where T3 is assumed

to be L and T2 is R.)

The similarity between (4.2-1a) and (4.2-2) suggests that these two rules are really one and the same. Since both Tianjin and Mandarin are dialects of the Mandarin cluster, this is hardly surprising. The implication of this is as follows:

Any argument for Mandarin tone sandhi based on prosodic headedness must extend to Tianjin. To illustrate this, consider two hypotheses − firstly assuming that Mandarin is left-headed, thence by extension Tianjin is left-headed and secondly assuming that it is right-headed, thence by extension Tianjin too.

Assuming left-headedness requires that alternation L → R / __ L appeals to some markedness property obligatory of heads, conceivably that head elements should carry a high tone (de Lacy 1999). Putting aside problems already discussed in Chapter 2, section 2.5, this approach might work for Mandarin. However, extension to Tianjin would not be possible. This is because in Tianjin, there are cases like R → H / __ R and F → L / __ F. The initial tone R already has a high tone in it and so one is in need of finding a motivation for its alternation, especially when the result of that alternation is a tone relatively more simplex than the following tone. In F → L, the situation is worse. The initial tone is in fact losing the high tone. Tianjin makes appeals to headship on the left element unfeasible. Abandonment of this account for Tianjin would therefore require the same of Mandarin, given that the set of tone sandhi rules in Tianjin is a superset of the tone sandhi rule in Mandarin.

The second hypothesis that Mandarin is right-headed fares a little better. Assuming that Mandarin is right-headed would automatically account for the stability of the final tone. This can be extended naturally to Tianjin, since all final tones in Tianjin are stable.

While Mandarin and Tianjin headedness and tone sandhi rules are similar, there is some difference in the way tone sandhi rules apply. In Mandarin, tone sandhi applies to prosodic structures that parallels morphosyntactic configuration. Tianjin's prosodic structures are more divorced from morphosyntax by the high ranking of prosodic structural constraints such as BINARY AND ALIGN LEFT. This is essentially why Tianjin exhibit directionality effects that Mandarin do not. Another aspect in which the two languages differ is the number of active sandhi-triggering constraints (effect due to typologically different ranking relationships between faithfulness constraints the various OCP requirements on tone contour adjacencies [1]). Tianjin has more active OCP constraints at work than Mandarin. This is why Tianjin has the "direction flip" effect that Mandarin does not. Given the singular Mandarin tone sandhi rule, alternations can never lead to further sandhi triggering environments.

The next section moves on to discuss the absorption rules of Tianjin. As one may recall, ICT recognizes that constraints may be inter-tier effective or they may be root-effective. It is the latter that the next section explores.

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[1] For Mandarin, the ranking would be OCP [L] » FAITH » OCP [R, F, H]. For Tianjin, OCP [R, F, L] » FAITH » OCP [H].

4.3. Tone sandhi suspension

Recall from Chapter Three that absorption rules apply only once to all applicable environments after dissimilation has taken its toll (relevant patterns repeated below).

(4.3-1) Patterns in Tianjin relevant to once-and-for-all effect

Pattern	Input	Dissimilation rightwards	Flip	Absorption	Output
P1	FFL	LFL	-	LHL	LHL
P3	FFF	LLF (via LFF)	FLF	HLF	HLF
P8	LRH	-	-	LLH	LLH
P9	LRF	-	-	LLF	LLF
P10	RRH	HRH	-	HLH	HLH
P11	RRF	HRF	-	HLF	HLF
P13	FRH	-	-	FLH	FLH
P14	FRF	-	-	FLF	FLF
P15	RFL	-	-	LHL	LHL

The question is: how is it that apparently sandhi-triggering environments (P8, P9, P13 and P14) are tolerated if they are the result of absorption?[2]
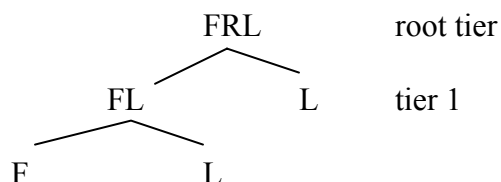
4.3.1. INDEX PRESERVATION

Given that absorption rules apply only once and that it applies only after dissimilation, it should be rather straightforward that this once-and-for-all effect must be attributed to the application of WF-A constraint being root-effective only (to use inter-tier correspondence terminology). However, this will not suffice, as the following example illustrates. Consider for example P9 (P8 and P9 present identical problems in this respect, solving

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[2] The observant reader might notice that CT COND from Chapter Three, section 3.5.3 would effectively preempt the offending surface collocations of P8, P9, P13 and P14 from alternating. However, given P15 (see discussion in section 3.5.3), this approach is not feasible. P15 demands that WF-A outranks CT COND.

one would solve the other), where /LRF/ → [LLF], in conjunction with P7, where /FLL/

→ [FRL]. Under inter-tier correspondence, P7 would be accounted for as in (4.3-2)

(4.3-2) Account of P7[3]

```
                    FRL          root tier
                   /   \
               FL        L       tier 1
              /  \
            F      L
```

As a root-effective only constraint, WF-A does not apply at tier 1, thus keeping

FL intact there without changing to HL. WF-D, with its inter-tier effectiveness, must

apply to the root node, so that the medial L becomes R (thus bleeding application of FL

→ HL). With this in mind, WF-D applies to the root node of P9 also. In that case, WF-A

would not have needed to apply (on grounds of faithfulness in correspondence). However,

in the case of P9, WF-A must apply, implying that WF-D must NOT apply given the L

adjacency. The crux of this conflict is shown below.

(4.3-3) Undetermined root node of P9

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                    ???          root tier
                   /   \
               LR         F      tier 1
              /  \
            L      R
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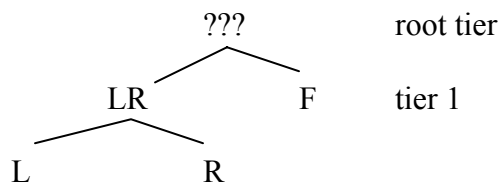
[3] A right-branching structure will not be more harmonic than this left branching one in this case because WF-A is root effective only, thus no violations with the FL adjacency at tier 1. While a right-branching structure in this case may do away with the stipulation that WF-A is root-effective only, it would bring about other problems as WF-A is crucially fed by results of WF-D.

The challenge is thus to resolve the conflict in such a way that one ends up with [LLF] for P9 rather than with anything else. To have a complete grasp of the picture, note at the onset that with a case like P9, one must make sure that WF-D does not result in a reconfiguration of the structure, something that has been shown to be possible in chapter 3, section 3.4 (specifically through the ranking of BIN over WF-D, see (3.4-5)). Reconfiguring the structure to be right branching would of course produce an unattested outcome. Having said this, the task at hand is to eliminate candidates (ii) & (iii) below[4].

(4.3-4)   i.   LLF   (desired optimal)

                          LR   F

                      L   R

          ii.   RLF

                      L   LF

                            R   F

          iii.   LRF

                      LR   F

                  L   R

The simplest and most obvious way to the elimination of candidate (ii) and candidate (iii) would be to show that the LL sequence in candidate (i) is not of the same nature as that punishable under WF-D. That would automatically remove candidate (ii) because there will be no longer any motivation to pick a non-optimal structure (by the

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[4] I am of course assuming that there are constraints limiting what each underlying tone can alternate to in response to either WF-D and WF-A. Exactly how to do this is not directly relevant now, but will be addressed later.

requirements of BINARY and ALIGN LEFT) and remove candidate (iii) by the requirements

of WF-A (which disprefers RH and RF surface sequences). Evidently, assuming that the

LL in candidate (i) is the result of sharing one L with two tone bearing units is not going

to work. This is because there is no way to prevent such a move from extending to

resolving other LL violations not triggered by WF-A. I thus propose that the reason

behind the tolerance of the LL in P9 is the elimination of the constituent high tone of the

underlying medial R without deletion of its index, i.e. having a floating high tone. To

illustrate this, consider magnifying the root node of candidate (i) as follows.

(4.3-5) candidate (i)
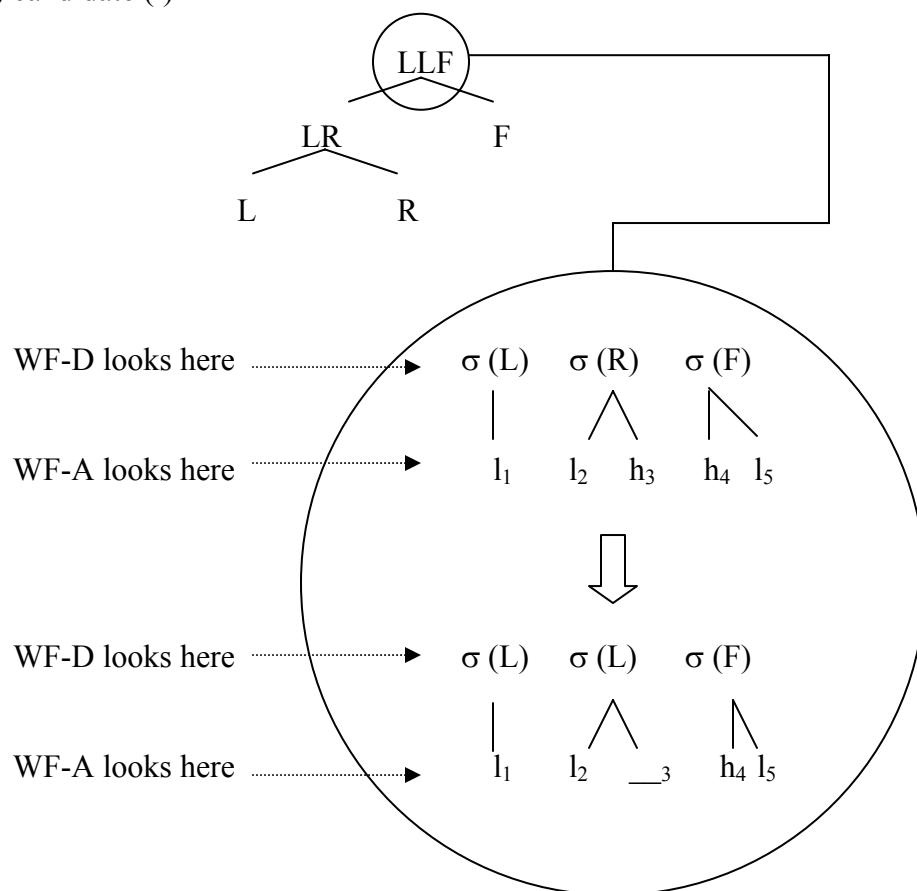
Two crucial assumptions are needed for (4.3-5) to work. Firstly, WF-D applies as

an OCP on the TBU that contains the entire tonal contour (in this case represented by the

syllable) and secondly, WF-A applies as an OCP on the constituents of each contour. (These assumptions were implicit in treating WF-D and WF-A as different constraints anyway.) By preserving of the index from the constituent [h] in the medial R of P9, WF-D does not apply to the first substring of [LLH] derived from [LRH]. This is because the first substring no longer contains identical tonal contours now that the initial tone is a solitary [l] while the medial tone is a constituency of [l] and an empty element. The preservation of the index approach will work well for P8 too, where there is also an adjacency of L due to the application of WF-A. The matter is a little more delicate with respect to P13 and P14[5], but the general principle remains the same.

4.3.2. PHONETIC SUPPORT[6]

While index preservation works pretty well, it predicts that the L derived from the application of WF-A must be different from other Ls. We can thus imagine comparing three different kinds of Ls – the underived L (i.e. the L in LF); the L derived from WF-D (i.e. F $\rightarrow$ L / __ F) and; the L derived from WF-A (i.e. R $\rightarrow$ L / __ F). It is useful to recall here that the L tone in Tianjin has a falling contour. This pitch track is repeated from (3.1-2) here as (4.3-6).

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[5] With P13 and P14, the matter is more delicate because the counterbleeding involves an FL sequence, which is relevant to WF-A rather than WF-D. However, when viewed with the fact that FR does not undergo sandhi, the crux of the matter appear to lie in finding an explanation for why /FL/ $\rightarrow$ [HL] but not /FR/ $\rightarrow$ [HR]. Once this has been accounted for, the index preservation approach would work with P13 and P14 too.

[6] All pitch tracks and spectrograms made here are taken from recordings of the research supported by the Strategic Research Grant from the City University of Hong Kong (Project No 7000990). I am grateful to Matthew Chen for permission to use these materials.

(4.3-6) Pitch track of the Tianjin Ma1 (Low tone)
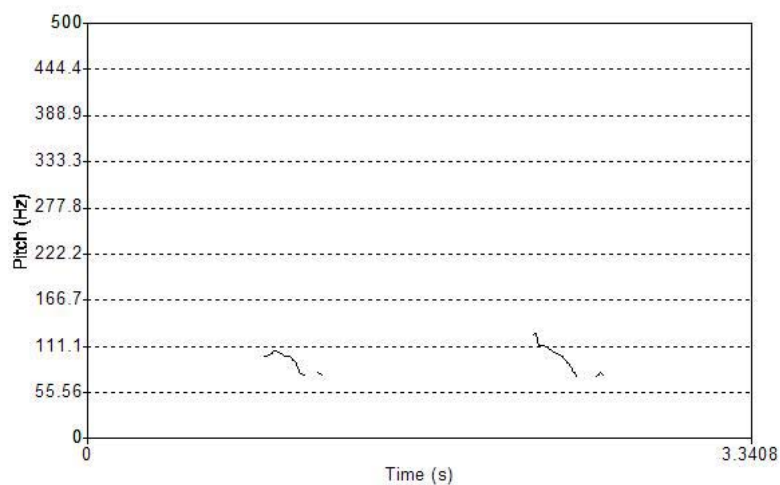
Thus, if the index preservation account is correct, then one would expect the L derived from R to be flatter in contour than the underived L. The following paragraphs will illustrate that this is indeed the case.

Using the recordings made by Chen et al (2003), one may compare 3 sets of pitch tracks, each set with three pitch tracks from the three different Ls. The first set of pitch tracks in (4.3-7) is for the underived L, the second set in (4.3-8) is for the L derived from WF-D. Finally in the third set (4.3-9) are pitch tracks for the L derived from WF-A. In all these pitch tracks, the part corresponding to the L tone in question is located at the first half. The second half belongs to the tone of the right adjacent syllable responsible for triggering any relevant alternation. In cases where the two syllables are separated by a voiceless consonant, a break may be observed in the pitch tracks. For convenience, the L part of each pitch track is circled.

(4.3-7) Underived L (or /LF/ → [LF])
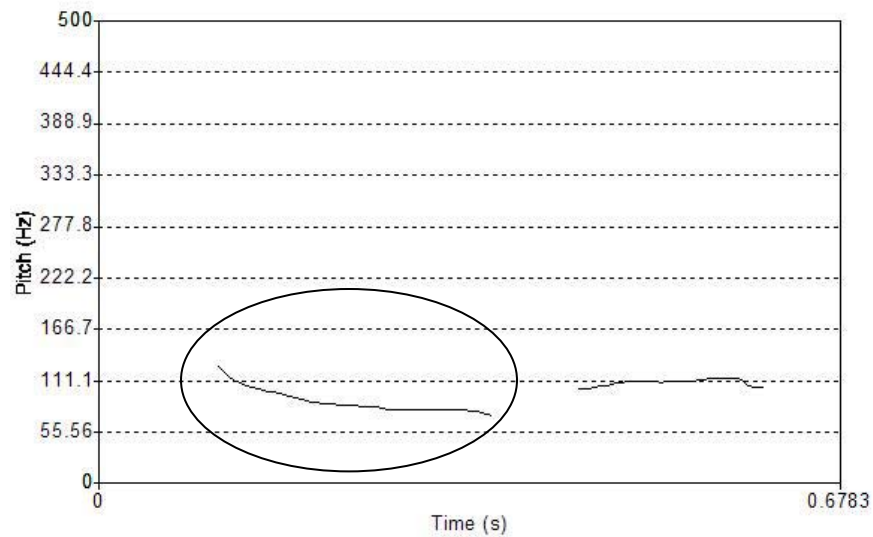
    a.   jinku   'gold vault'
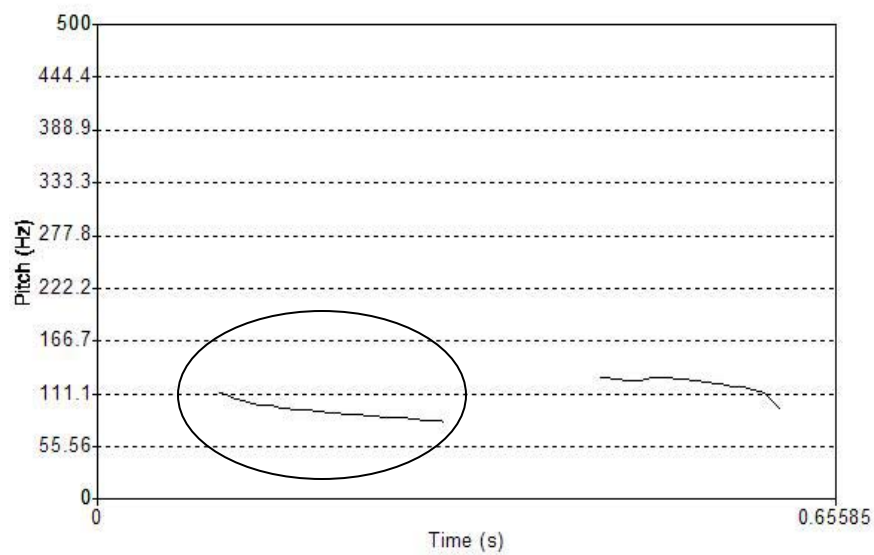
    b.   xiwang   'hope'
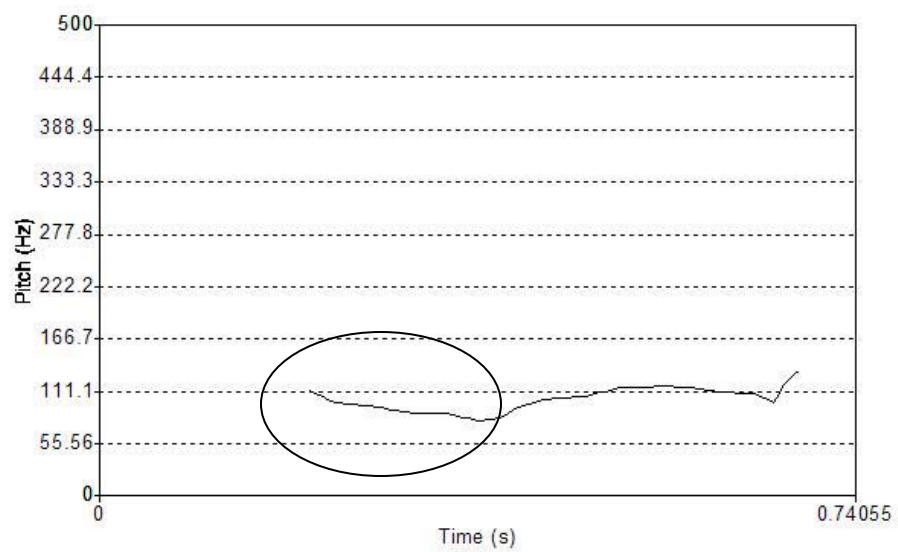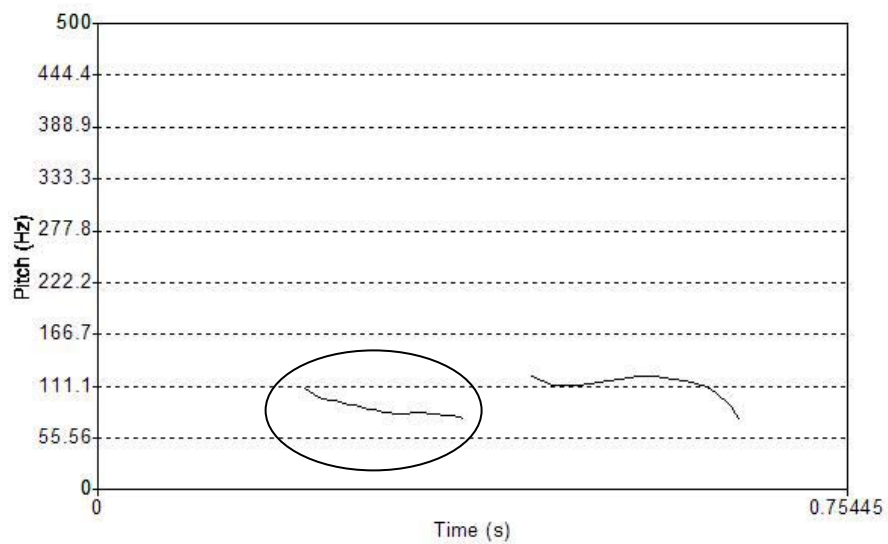
c.   jianghua   'petrify'
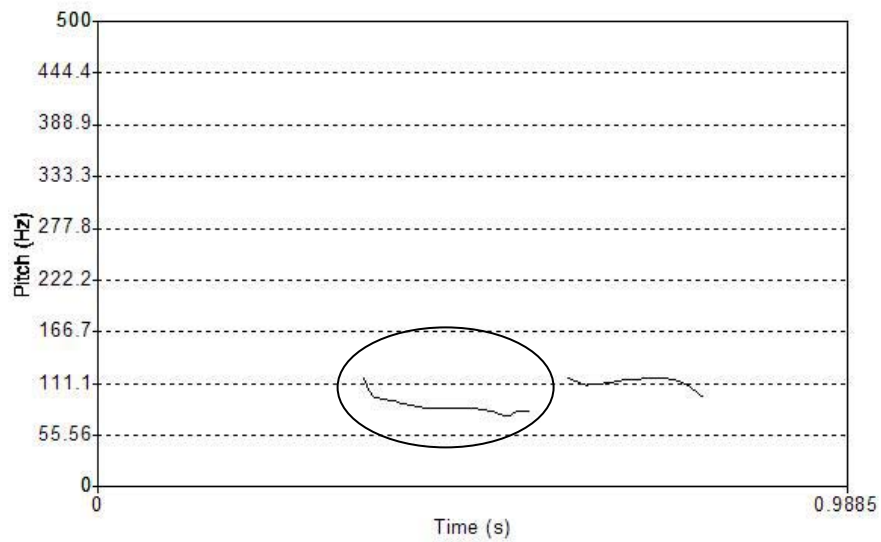

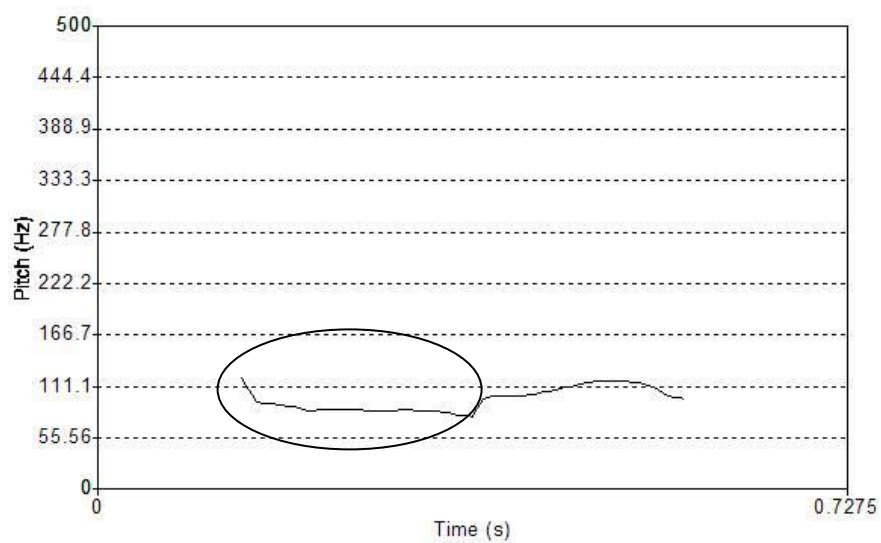(4.3-8) L derived by WF-D (or /FF/ → [LF])

a.   fugui   'wealth'

b.   shijie   'world'
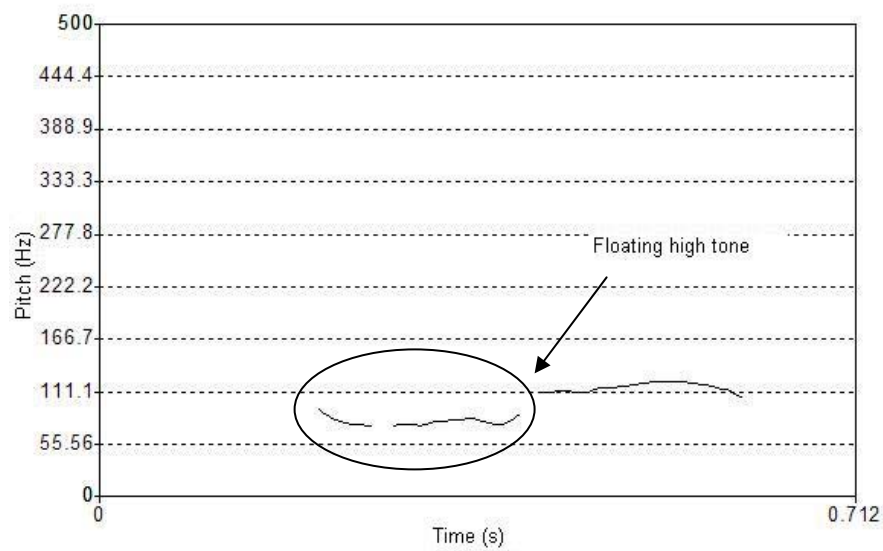

c.   yundong   'exercise/campaign'
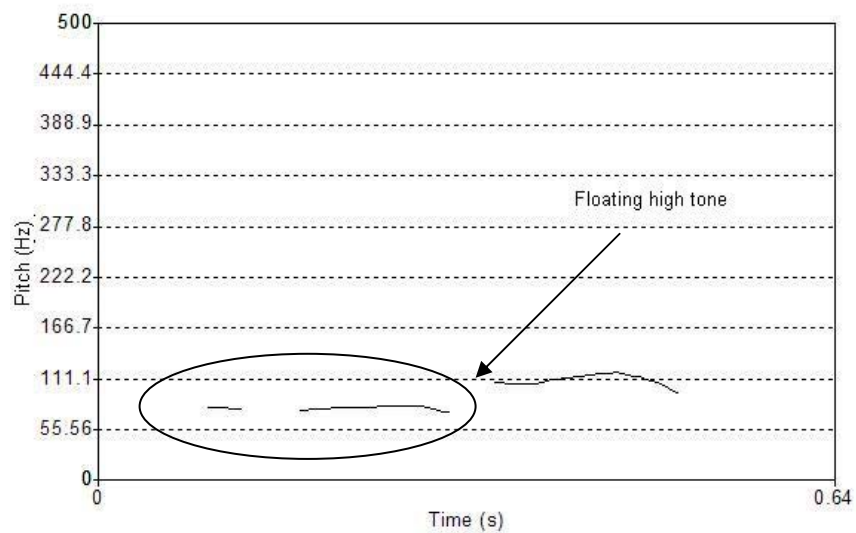
(4.3-9) L derived by WF-A (e.g. /RF/ → [LF])
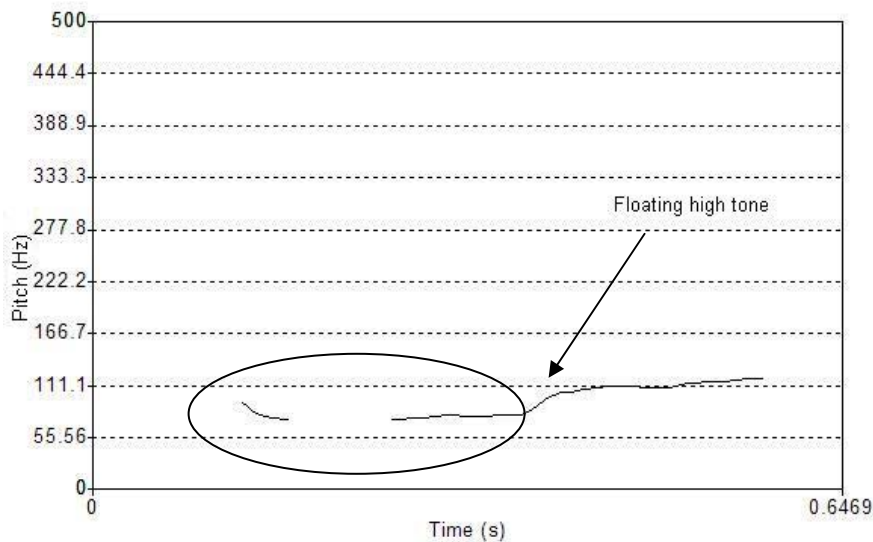
    a.   shouduan   'means/methods'

    b.   bandeng   'bench'

c. jianghua 'to speak'

Before making any comparisons, a few explanatory words are necessary. The break in the pitch track in (4.3-9c) is the result of some technical quirk, causing the machine to not pick up any frequency signals and has nothing to do with voicelessness. Otherwise, except for (4.3-7c) and (4.3-9c), segmental information varies. This is because such data pairs are unavailable from the recordings. Since it is the nature of the tonal contours that is of interest, this matter is trivial.

Recall that underived L and L derived from WF-D triggers WF-A (since WF-D feeds WF-A, e.g. P1 and P3), one would expect these two Ls to be similar. By this token, since the L derived via WF-A does not trigger any further sandhi, this L would be different from the other two. Thus, one would expect the pitch tracks in (4.3-7) and (4.3-8) to be similar with respect to the L tone, but (4.3-9) to be different.

Comparing the pitch tracks[7], two things are striking – firstly, L derived by WF-A tends to be flat (in contrast to the falling L of the other two kinds) and; secondly, the L

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[7] Pitch tracks for /LH/ and /RH/ though not included here, show similar contrasts between L derived from WF-A and other Ls.

derived from WF-A never begins at a point higher than the 111Hz frequency line (in contrast to the L beginning at minimally that pitch for the other two kinds). These two observations hold true for all the nine cases above. Although 9 is hardly a figure large enough to be meaningful in statistics, the convergence is quite striking. Thus this gives phonetic support to the proposal that the L adjacency tolerance is due to index preservation. Index preservation here is the same kind of floating tone effect frequently found in Benue-Congo languages where the effect of the deleted tone is left behind (Clements and Ford 1979, Pulleyblank 1986, Clark 1992, Odden 1995, Yip 2002 among others).

As mentioned earlier, the challenge posed by P8 is identical to P9, and so does not warrant any further discussion. P13 and P14, involves marked collocations that apparently pertain to WF-A, but since these collocations are derived, they too may arguably not have the sandhi triggering structure under the index preservation account. Verification would require a comparison between derived FL against underived FL (P13 and P14 have WF-A triggers on the surface) phonetically. This requires substantial work in phonetics that stretches the bounds of this dissertation and thus awaits future research.

4.4.   Tone selection

This section moves on to discuss the residue matter on tone selection. Although the main thrust of this dissertation pertains to the application of sandhi on windows AB and BC in some given ABC sequence, what A, B or C alternates with (i.e. tone selection) has not been addressed. This section devotes itself to matters on tone selection, but it does not present itself as an inherent part of inter-tier correspondence theory (rather only as a

complement to the theory), nor does this section present itself as a general theory on tone selection. It only takes into consideration the tone selection involved in Mandarin and Tianjin.

Recall that tone sandhi may be grouped into two categories – those involving dissimilation (Mandarin tone sandhi and Tianjin WF-D types of tone sandhi) and those involving absorption (Tianjin WF-A types of tone sandhi).

(4.4-1) a. Alternation by identity (dissimilation, WF-D)[8]

F → L / __ F

L → R / __ L (Mandarin tone sandhi shares this with Tianjin)

R → H / __ R

b. Alternation by partial identity (absorption, WF-A)

F → H / __ L

R → L / __ H

R → L / __ F

While OCP constraints on contours (OCP[TC]) and on features (OCP[TF]) may be invoked as triggers to these processes (see Chapter 3, section 3.1), they do not explain

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[8] Working on tone shifts in Chinese languages, Hirayama (1984 and 1991) argues that the pattern would be F → L → R → H → F, thus completing a circle such that complex tones are reduced by taking from the left edge and simplex tones are contoured by adding features to the right edge. Yan Xiuhong (p.c.) however reports that at least in Hakka languages, the arrows would point in a variety of directions. As such, I shall refrain from making arguments for these tone mapping patterns from a historical perspective.
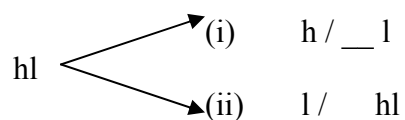
why, for example, L → R and not anything else. The problématique is pictorially described below.

(4.4-2) Mapping relations

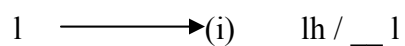| Underlying tone	Mapping under WF-D or WF-A	
F = [hl]	[lh]	✗
	[hl]	✗
	[h]	✓
	[l]	✓
L = [l]	[lh]	✓
	[hl]	✗
	[h]	✗
	[l]	✗
R = [lh]	[lh]	✗
	[hl]	✗
	[h]	✓
	[l]	✓

In (4.4-2), ✗ refers to unattested mapping while ✓ refers to an attested mapping. The matter on tone selection is thus essentially the distribution of ✗ and ✓. The pattern behind the mapping becomes clear when presented as the following:

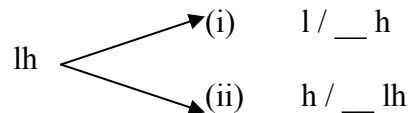(4.4-3) a.   Mapping of F

                                        (i)   h / __ l
                        hl
                                        (ii)   l / __ hl

        b.   Mapping of L

                l   (i)   lh / __ l

c.   Mapping of R

$$\text{lh} \begin{cases} \text{(i)} \quad \text{l} / \underline{\hspace{1em}} \text{h} \\ \text{(ii)} \quad \text{h} / \underline{\hspace{1em}} \text{lh} \end{cases}$$

(4.4-3) shows evidently, that the mapping must result in a collocation that is free from adjacency of identical tone features (i.e. satisfies OCP[x.x]). It is for this reason that F and R has two mapping possibilities depending on the tone feature that follows it. For example, with /hl/ (=F), [l] is deleted if the following tone feature is [l] (as in (i)) and [h] is deleted if the following tone feature is [h] (as in (ii)). The same logic applies to /R/. With L, avoidance of adjacent [l]s is done by inserting [h]. In essence, the selected tone for mapping must not result in an OCP[x.x] violation.

4.5.   Comparative markedness and tone selection

The application of OCP[x.x] as a key to tone selection calls to mind its exact position in the ranking hierarchy. In Chapter Three, section 3.1, it was first mentioned that WF-A is really OCP[xy.y], a special kind of OCP[x.x] (i.e. a constraint on adjacent identical tone features). WF-A addresses such alternations as /RH/ → [LH] (= /lh.h/ → [l.h]) which has an offending [h] adjacency. The difference between WF-A and OCP[x.x] is that the latter punishes also collocations such as /HF/, /HH/ and /LR/. These collocations however do not trigger tone sandhi. Consequently, it must be that OCP[xy.y] » FAITH » OCP[x.x]. At first blush, this ranking hierarchy works. Consider all the ditonal sandhi patterns as predicted in all six tableaux below.

(4.5-1) Dissimilation tone sandhi

a. /FF/ → [LF] or hl.hl → l.hl

/hl.hl/=FF Candidate	WF-D	WF-A	INTF	OCP[x.x]
i. hl.hl = FF	*!			
ii.☞ l.hl = LF			*	
iii. h.hl = HF			*	*!
iv. lh.hl = RF		*!	**	*

b. /LL/ → [RL] or l.l → lh.l

/l.l/=LL Candidate	WF-D	WF-A	INTF	OCP[x.x]
i. l.l = LL	*!			*
ii.☞ lh.l =RL			*	
iii. hl.l = FL			*	*!
iv.💣⁹ h.l = HL			*	

c. /RR/ → [HR] or lh.lh → h.lh

/lh.lh/=RR Candidate	WF-D	WF-A	INTF	OCP[x.x]
i. lh.lh = RR	*!			
ii.☞ h.lh =HR			*	
iii. l.lh = LR			*	*!
iv. hl.lh = FR		*!	**	*

---

[9] This candidate is not as on par with the desired optimal as it appears on this tableau. It drastically changes the identity of the input tone from L to H, involving simultaneously a deletion of the L and the epenthesis of H. The desired optimal involves only epenthesis of H. The desired optimal is therefore more faithful.

(4.5-2) Absorption tone sandhi

    a.   /FL/ → [HL] or   hl.l → h.l

/hl.l/=FL Candidate	WF-A	INTF	OCP[x.x]
i. hl.l = FL	*!		
ii. l.l = LL		*	*!
iii. ☞ h.l = HL		*	
ii. lh.l =RL		**!	

    b.   /RH/ → [LH] or   lh.h → l.h

/lh.h/=RH Candidate	WF-A	INTF	OCP[x.x]
i. lh.h =RH	*!		
ii. h.h = HH		*	*!
iii. ☞ l.h = LH		*	
iv. hl.h = FH		**!	

    c   /RF/ → /LF/ or   lh.hl → l.hl

/lh.hl/=RF Candidate	WF-A	INTF	OCP[x.x]
i. lh.hl =RF	*!		
ii. h.hl = HF		*	*!
iii. ☞ l.hl = LF		*	
iv. hl.hl = FF		**!	

(4.5-1) and (4.5-2) do not consider candidates where the final tone contour alternates (i.e. no examples of A → A'/ A __ type) since Tianjin tone sandhi is strictly regressive. This property is taken care of by the right-headedness assumption that keeps the tone contour on the right edge stable. INTF is the inter-tier faithfulness constraint that is used here to evaluate for faithful preservation of tone features.[10]

Such an account however does not stand up to scrutiny. The appeal to OCP[x.x] as key to tonal selection for dissimilatory sandhi cases fails the moment one considers

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[10] Counting INTF violations in terms tone features does not adversely affect the way the constraint was used in Chapter Three as it is just a refinement on the representation of contour tones.

/RRR/ or /FFF/. As an illustration, consider the situation with /FFF/ below. (For details on /FFF/, see Chapter Three, section 3.4.3.)

(4.5-3)   P3:   /FFF/ $\rightarrow$ [HLF]   violations:count

      Candidate i: hl.+h.hl (= [FHF])   OCP[x.x]:1

                hl   h.hl   OCP[x.x]:1 INTF:1

                       hl   hl

      Candidate ii: h+l.hl (= [HLF])   INTF:1

                hl   l.hl   INTF:1

                       hl   hl

/FFF/ candidate	WF-D	INTF	OCP[x.x]
�☀ i.		*	**
☞ ii.		**	

☞=desired optimal   ☀=predicted optimal

In (4.5-3), candidate i violates of OCP[x.x] as prevention for subsequent violations of INTF as one moves up each tier. Thus, candidate i is erroneously preferred over the attested candidate ii. Note that OCP[x.x] does not apply at the intermediate tier because as part of the WF-A family, it has root-effectiveness only. Even if this was relaxed, it would not help. Also, reranking of OCP[x.x] and INTF(MAX) is not viable since not OCP[x.x] does not trigger alternation. Either ways, appeal to OCP[x.x] for tone selection for dissimilation cases makes the wrong predictions. A similar situation may be constructed with P2: /RRR/ $\rightarrow$ [HHR].

To solve this conundrum, it is important to recognize that while OCP[x.x] are often tolerated with underived tones, it is never tolerated with derived tones. This calls to mind the insight behind comparative markedness theory (McCarthy 2002). Under comparative markedness, markedness constraints belong to two different kinds – one that punishes underived marked forms (*M_O, i.e. old marked environment) and another that punishes derived marked forms (*M_N, i.e. new marked environment). These two sides of the same coin interact with faithfulness constraints producing four possibilities, all of which are explained below.

(4.5-4) Typology: comparative markedness with faithfulness

    i.   *M_O; *M_N » FAITH

             All surface forms contain no marked environments.

    ii.   FAITH » *M_O; *M_N

             All surface forms are identical to underlying forms.

    iii.   *M_O » FAITH » *M_N

             Derived marked environments are tolerated, but not underived ones.

    iv.   *M_N » FAITH » *M_O

             Underived marked environments are tolerated, but not derived ones.

In terminal based OT accounts (that is, any OT account that does not use inter-tier correspondences), the expression of comparative markedness appears awkward because of its reference to derivations. However, this notion is natural with inter-tier correspondence representations because information in a dominating node would be

"derived" from its constituent nodes (details, see Chapter One). Therefore, only unfaithful upward percolation could result in a violation of $*M_N$. So, in fact, all one needs is an $OCP_N[x.x]$ that applies to all derived environments, with a ranking of the type in (4.5-4iv.) This is shown below, again using P3 /FFF/ as an example.

(4.5-5)　　　　P3:　　/FFF/ → [HLF]　　　　　　　　violations:count

Candidate i:　　　　　hl.+h.hl (= [FHF])　　OCP[x.x]:1

　　　　　　　　hl　　　　　　h.hl　　　　　　INTF:1
　　　　　　　　　　　　　　　　　　　　　　$OCP_N[x.x]$:1

　　　　　　　　　　　hl　　　　　hl

Candidate ii:　　　　h+l.hl (= [HLF])　　INTF:1

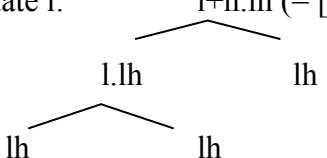　　　　　　　　hl　　　　　　l.hl　　　　　　INTF:1

　　　　　　　　　　　hl　　　　　hl

$OCP_N[x.x]$　　Mismatched inter-tier correspondences (in other words, unfaithful inter-tier correspondence) may not have adjacent identical tone features.
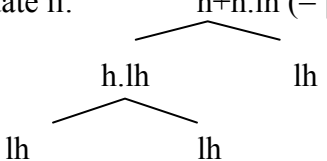
/FFF/ candidate	$OCP_N[x.x]$	WF-D	INTF	OCP[x.x]
i.	*!		*	*
☞ ii.			**	

$OCP_N[x.x]$ does not adversely impact on the ditonal cases as none of the optimal cases involve a derived [x.x]). Given the way $OCP_N[x.x]$ is formulated, the adjacent [h] at the root node of candidate i does not constitute a violation. This is because this collocation is inherited from the constituent nodes rather than derived. Taking this cue, ICT is actually indispensable for an account in tone selection. To see the importance of ICT in dealing with tone selection, consider now P2: /RRR/ → [HHR]. Notice the adjacent Hs in the

initial substring. Since these two Hs are derived, would not that constitute a violation of

OCP_N[x.x]?

(4.5-6)   P2:   /RRR/ → [HHR]   violations:count

Candidate i: l+h.lh (= [HLF])   INTF:1

                l.lh   lh   OCP_N[x.x]:1
                                                INTF:1
        lh   lh

Candidate ii: h+h.lh (= [HHR])   INTF:1

                h.lh   lh   INTF:1

        lh   lh

OCP_N[x.x]   Mismatched inter-tier correspondences (in other words,
                unfaithful inter-tier correspondence) may not have adjacent
                identical tone features.

| /RRR/ candidate	OCP_N[x.x]	WF-D	INTF	OCP[x.x]
☞ i.	*!		**	*
ii.			**	*

Notice that in (4.5-6) candidate ii, there is a [h] adjacency at the root node. If OCP_N[x.x]

applies without reference to inheritance from lower tiers, then candidate ii would be share

all the violations of candidate i, thus predicting optionality between the two candidates.

Breaking this tie requires that OCP_N[x.x] applies only when unfaithful percolation results

in identical tone features being adjacent. This cannot be formulated without reference to

structures since a terminal-based treatment (see Chapter One) would view the [h]

adjacency as derived.

## 4.6. Dipping or low tone in Mandarin

The above discussions have concentrated mostly on Tianjin making hardly any reference to Mandarin. This indulgence is granted based on the observation that the Mandarin tone sandhi rule (T3 → T2 / __ T3) is a subset of the Tianjin rules (since Mandarin T2 is R and T3 is arguably L). This view of Mandarin tone sandhi puts the spotlight on a long-standing debate about the nature of the T3 as well as the sandhied T2.

As noted in Chapter Two, T3 is Mandarin varies phonetically across speakers. For some speakers, it is a low tone (see pitch track from Shih 1988) where for some, it is a dipping tone (see pitch track as articulated by the writer).

(4.6-1) a.   Pitch Tracks of the Mandarin Tones from Shih (1988)

The syllable MA with four tones
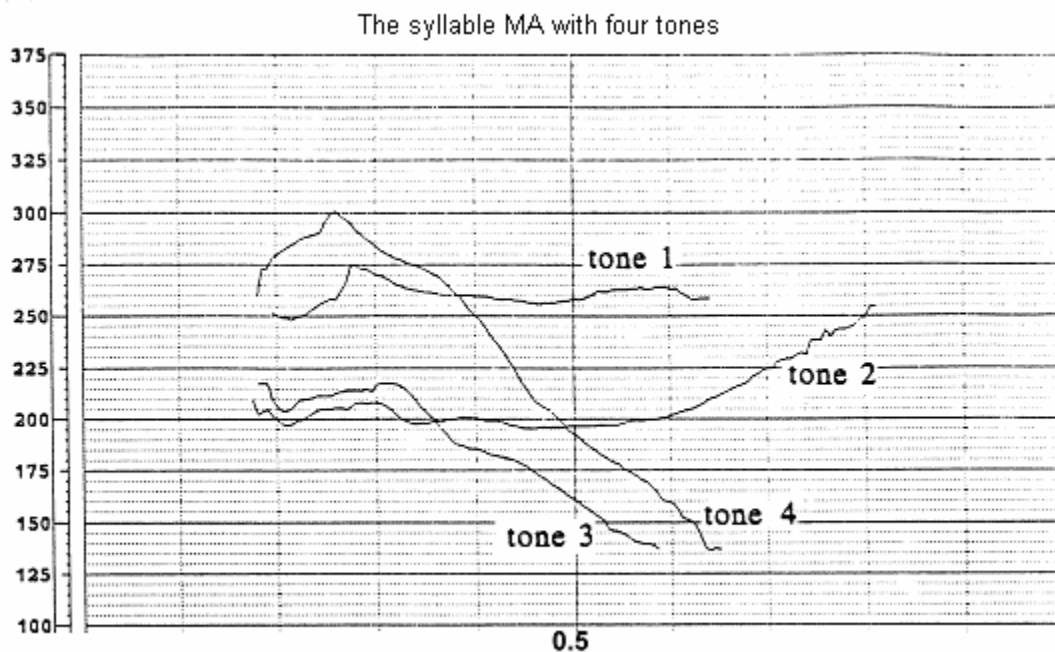
b.   Pitch Tracks of the Mandarin Tones articulated by the writer
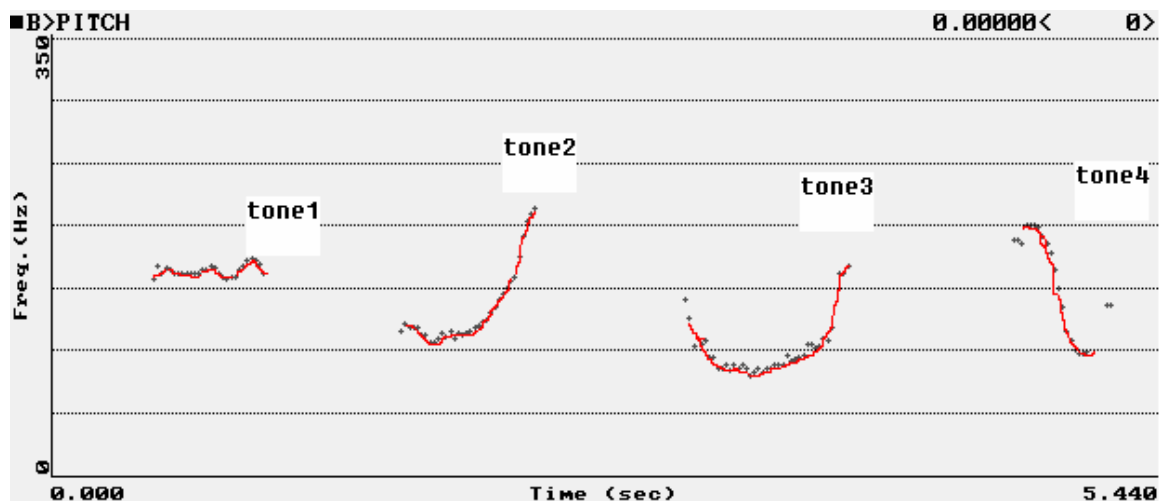
Many accounts of Mandarin tonal inventory describes T3 as [214] (following the tone letter system where 1 = lowest and 5 = highest). Speakers of Mandarin whose articulation of T3 matches Shih's description are mostly from the south. Speakers who articulate T3 as [214] are often from the north. So, let us call these two groups of speakers the southern-speakers and the northern-speakers.

Even though the phonetic nature of T3 varies across speakers, both Shih speakers and textbook speakers share the same tone sandhi target in that T3 alternates with a rising tone. Now, the discussion on tone selection in the earlier section is clearly compatible with the Southern speakers as it fits squarely with /l/ → [lh] / __ l. Recall that for Southern speakers, T3 is a low tone.

The matter becomes a little more complicated with northern speakers. This is because if T3 is construed as [214], then it certainly is not a case of L adjacency, but rather collocation of two dipping tones. Triggering alternation here is not a problem, since an OCP on tone contour (i.e. OCP[TC]) would suffice. Thus the Mandarin ranking

hierarchy for triggering tone sandhi would be (4.6-2) regardless of the dipping quality of T3.

(4.6-2) OCP[T3]; FAITH » OCP [T1, T2, T4]

That said, one can concentrate on obtaining a rising tone out of a dipping one? The most obvious approach would be to either remove the high bit on the left edge of the dipping contour, thus making a [14] out of [214] or remove the middle bit, thus making [24] out of a [214]. Now, the pitch description for T2 is [35] (see Chapter Two, section 2.1). This would mean that both approaches predict that the rising tone produced by T3 sandhi (be it [14] or [24]) is not the same as T2 (which is also rising). At this point, there are two issues to address – (i) does this affect the earlier analysis on tone selection and (ii) is there any phonetic evidence to show the difference between sandhied T3 and regular T2.

Addressing (i) first, recall that central to the treatment on tone selection is the requirement that derived tones do not have adjacent identical tone features. Thus even for northern speakers of Mandarin where T3 is [214], T3 adjacency does not have any OCP[x.x] violations since the initial tone ends in a [h] (= […4]) and the final tone begins with [l] (= [2…]). Moving on to (ii), Yin (2002) argues that the rising tone derived from T3 sandhi is different from T2. In fact, Yin cites phonetic studies from Xu (1997) that the sandhied tone is more akin to [14] than to the [35] of T2. As explained above then, the account on tone selection accommodates both views of Mandarin tone sandhi, regardless of the precise description of T3.

4.7. Summary

This chapter addresses neutralization in Mandarin, absorption in Tianjin and the mapping of underlying tones to sandhied tones in these two languages. These are residual issues not directly related to the inter-tier correspondence theory (ICT), but are nonetheless crucial for a complete account of the two languages in question. This is because these issues relate to phenomena that either (i) threaten ICT as an account for the derivational effects or (ii) do not require inter-tier correspondence as a tool. Phenomena pertaining to (i) include neutralization in Mandarin which creates more change than the structural configuration apparently allows and absorption in Tianjin which seem to undo certain dissimilatory processes. In response to Mandarin neutralization, the main idea is to assume a tone reducing suffix, thus giving the representation as many tiers in structures as needed for all the alternations to occur. This move also makes a right-headed assumption of Mandarin prosody viable because the rightmost syllable which tone is reduced is no longer head at the higher tier where suffixation occurs. On Tianjin absorption, tolerance of certain collocations is explained the fact that these collocations are in reality not the same ones that trigger tone sandhi. Essentially, phonetic evidence shows that tones derived via absorption are different from those that trigger sandhi.

The phenomena pertaining to (ii) would be on the mapping between underlying tones and sandhied tones, which apparently does not call for the elaborate inter-tier correspondence notation. This is because, ditonal sandhi simply does not produce a OCP[x.x] situation (i.e. a situation where two adjacent tone features are identical). This however does not extend very well to longer strings such as /FFF/ and /RRR/. To

accommodate these cases, it turns out that inter-tier correspondence is after all necessary so that certain derived OCP[x.x] are not punished while others are. This makes the ICT more important and necessary in providing a complete account to Mandarin and Tianjin than just capturing the opaque and derivational effects discussed in the preceding chapters.