Volume 17
Issue 1 *Proceedings of the 34th Annual Penn Linguistics Colloquium*

Article 7

2011

Changzhi Suffix Tonal Reduplication

Tsung-Ying Chen
University of Alberta

Changzhi Suffix Tonal Reduplication

Abstract

In this paper, a floating tonal reduplicant suffix is proposed to re-analyze Changzhi Chinese suffix tone sandhi (Hou 1983), which has been presented as major evidence for Contour Tone Units (CTU). All stem contour tones in Changzhi, except one stem level tone, overwrite the underlying tone (HMH) of the adjectival and diminutive suffixes. In Yip (1980, 1989), this process was analyzed as spreading contour tones as units. The stem level tone was assumed to be assigned by a Default Tone Rule ordered after the tonal spreading rule. However, this CTU-based analysis has a problem of ordering paradox that derives incorrect outputs of the general disyllabic patterns. Combining with the primary concept of 'tonal copying' process proposed by Duanmu (1990, 1994), the framework of Base-Reduplicant Correspondence (McCarthy and Prince 1994, 1995) of Optimality Theory (Prince and Smolensky 1993/2004) has a more plausible explanation to Changzhi suffix tone sandhi. The OT analysis suggests that a floating tonal reduplicant T-RED accompanies the suffixes in Changzhi. The correspondence between the stem tonemes and T-RED is faithful, and the latter docks onto the suffixes whose underlying tonemes are then overwritten by this process. The stem level tone is not an exception; it undergoes the same reduplication process, but covertly, with the unchanged surface tonal sequence.

Changzhi Suffix Tonal Reduplication

Tsung-Ying Chen[*]

1 Introduction

Changzhi is a Chinese dialect that is mainly spoken in Shangxi province in Mainland China (Hou, 1983). There are five lexical tones in Changzhi, which are H (*Yin-Chu*), HM (*Yang-Chu*), MH (*Yang-Ping*), MLM (*Ying-Ping*), and HMH (*Ying-Shang*).[1] As in many East Asian tone languages, tone sandhi patterns are abundant in Changzhi. Table 1 represents the disyllabic outputs of two lexical tones that may undergo tone sandhi (sandhi tones are in bold). Assuming that all the tone sandhi patterns are phonological, we can summarize the disyllabic tonal phonotactics in Changzhi column-by-column from Table 1 as follows: *MLM-MLM, *MH-MLM, *MLM-HMH, *MH-HMH, *HMH-HMH, *H-HMH, *HM-HMH, *MLM-H, *MH-H, *HMH-H, *H-H, and *H-HM.

Tone2 / Tone1	MLM	MH	HMH	H	HM
MLM	MLM-**HM**	MLM-MH	**MH-HM**	MLM-**HM**	MLM-HM
MH	MH-**HM**	MH-MH	MH-**HM**	MH-**HM**	MH-HM
HMH	HMH-MLM	HMH-MH	**MH-HM**	HMH-**HM**	HMH-HM
H	H-MLM	H-MH	**MH-HM**	**HM**-H	**HM**-HM
HM	HM-MLM	HM-MH	**MH-HM**	HM-H	HM-HM

Table 1: General disyllabic outputs in Changzhi.

When a disyllabic form is derived from a morphological process of suffixation with an adjectival /ti/ or a diminutive /tə(ʔ)/ that can be independently produced with its lexical tone HMH, another tone sandhi pattern occurs. As shown from (1a) to (1d), it is obvious that stem tones are copied to overwrite suffix tones. Moreover, it is possible to violate tonal phonotactics when this suffix tone sandhi applies as in (1a) and (1b). A more puzzling example is (1e); when the stem tone is H, it does not overwrite the suffix tone (i.e., *aŋ^{H} ti^{H}) and at the same time, it also violates one of the tonal phonotactics.

(1) a. suaŋ^{MLM} + ti^{HMH} → suaŋ^{MLM} ti$^{\mathbf{MLM}}$ 'sour' (violates *MLM-MLM)
b. yaŋ^{HMH} + ti^{HMH} → yaŋ^{HMH} ti$^{\mathbf{HMH}}$ 'soft' (violates *HMH-HMH)
c. laŋ^{HM} + ti^{HMH} → laŋ^{HM} ti$^{\mathbf{HM}}$ 'rotten'
d. xuaŋ^{MH} + ti^{HMH} → xuaŋ^{MH} ti$^{\mathbf{MH}}$ 'yellow'
e. aŋ^{H} + ti^{HMH} → aŋ^{H} ti^{HMH} 'dark' (violates *H-HMH)

Changzhi suffix tone sandhi thus raises two questions. First, why can tonal phonotactics be violated in (1)? Second, why does the stem tone H in (1e) fail to be copied onto the suffix? This paper starts with the previous rule-based analyses in Section 2 and discusses how these approaches are not successful with an apparent ranking paradox. In Section 3, I will propose that adjectival and diminutive suffixes are accompanied by a floating tonal reduplicant. The patterns (1) are thus

[*]The author is grateful to the committee, audience, and three anonymous reviewers of the 34th Pennsylvania Linguistic Colloquium. In particular, the help from Kobey Shawyer, Lauren Friedman, and Meredith Tamminga is much appreciated. The useful comments from Anne-Michelle Tessier and Robert Kirchner improved the preliminary draft of this paper as well, and the author is therefore solely held responsible for the remaining imperfections. Finally, the author wishes to express his gratitude for the generous support in the form of travel funds from the Social Science and Humanities Research Council of Canada (SSHRC).

[1]The categorical transcription here corresponds to the five-scale transcription in previous studies as follows: H=44, HM=53, MH=24, MLM=213 and HMH=535 (5 = highest, 1 = lowest). The categorical transcription used here aims to make the following analysis more comprehensible. *Ying* and *Yang* refer to historical tonal categories that represent different onset-voicing conditions (*Ying* = voiceless, *Yang* = voiced).

U. Penn Working Papers in Linguistics, Volume 17.1, 2011

the results of reduplicating the stem (base) tonemes as tonal reduplicants that in turn dock on the suffix. This analysis is intuitive with BR-Correspondence (McCarthy and Prince 1994, 1995) under the framework of Optimality Theory (OT; Prince and Smolensky 1993/2004). This approach enables the patterns in (1) to be consistently explained by the same reduplication process. The seeming exception of (1e) is not an underapplication of the process; the stem tone H is *covertly* reduplicated onto the suffix without changing the tonal sequence in the output. The difference between total reduplication and suffix tonal reduplication in Changzhi can also be further clarified with the analysis in Section 4.

2 The failure of rule-based analyses

2.1 Contour Tone Spreading

The first analysis of Changzhi suffix tone sandhi follows the clear boundary between African tone languages and Asian tone languages defined by Pike (1948). The former was categorized as 'register tone languages' and the latter as 'contour tone languages'. This is to say that the dimension used to distinguish one tone from the other is *pitch height* in African tone languages, but *pitch contour* in Asian tone languages. This generalization comes from the fact that most African tone languages only have lexical level tones (e.g., H, M, L) and Asian tone languages usually have a mixed inventory of level and contour tones. Another observation made by Pike is that if an African tone language has a contour tone, it can be decomposed to separate level tones on different tone-bearing units (TBU, e.g., /$\sigma^{HL}\sigma$/ → [$\sigma^{H}\sigma^{L}$]); this feature is rare in Asian tone languages.

Following the development of Autosegmental Phonology by Goldsmith (1976), Yip (1989) clearly defines the representational difference between the contour tones of the two tone language groups (Figure 1). In Figure 1 (a), each level tone is associated with one tonal node that associates to a TBU (presumably a syllable). By contrast, the two level tones are only associated with one single tonal node in Figure 1 (b). Since a tonal node does not undergo fission, as does a cell, the node in Figure 1 (b) cannot split into different level tones. Any representation similar to Figure 1 (b) is treated by Yip as a Contour Tone Unit (CTU) that is a unique structure of Asian tone languages.

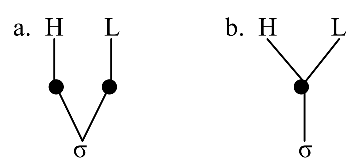

Figure 1: Autosegmental representation of a falling contour tone in African tone languages (a) and Asian tone languages (b).

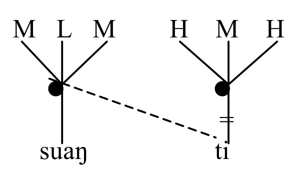

Figure 2: Contour tone spreading of (1a).

This representational difference also predicts that contour tones in Asian tone languages are able to spread as units by associating the single tonal node in Figure 1 (b) to other TBUs. The suffixed forms in Changzhi in (1) are quoted as direct evidence of the CTU and of contour tone spreading. Taking (1a) as an example, Changzhi suffix tone sandhi can be derived via the spreading process shown in Figure 2. Following this spreading process, the contour tone on the suffix is deleted due to the tonal crowding effect that prohibits a many-to-one association between multiple tones and a TBU.

The CTU-based analysis can sufficiently explain the patterns from (1a) to (1d); the pattern in

(1e) remain a challenge to this approach, however, since H on the stem does not spread. I will return to this issue in Section 2.3. It is more important to point out that the CTU might be nothing but an illusion since it has typological counterexamples (i.e., African contour tones in Asian tone languages) and requires arbitrary rules to defend itself.[2]

2.2 Morpheme-specific tonal reduplication

Duanmu (1994) argues against the CTU approach to tone sandhi on the suffixed forms in Changzhi and proposes that the contour tones on the stem are copied onto the suffix with a morpheme-specific rule application of a delinking rule followed by a reduplication rule. The sequential derivation based on (1a) is illustrated below in Figure 2.

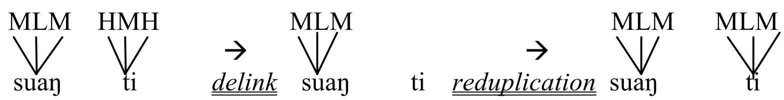

Figure 2: Rule derivation of the non-CTU reduplication process.

This analysis is not significantly different from the CTU-based approach in the sense that both focus on how the stem contour tone completely overwrites the tone on the suffix. Without a single tonal node of the CTU structure, Duanmu derives the correct output via a reduplication process. Due to the same focus, however, Duanmu's approach has the same limited analytical scope; he must answer why these rules do not apply when the stem tone is H in (1e).

2.3 Rule-ordering paradox

Despite these different theoretical foundations, both the CTU and the non-CTU analyses share the identical interpretation of (1e). That is, the UR of the stem with H is in fact tonally unspecified; H is assigned by a Default Tone rule through the derivation. Because this rule is ordered after (and thus counterfeeds) the spreading/reduplication rule, spreading/reduplication does not occur when the stem is toneless. The derivation of (1a) and of (1e) are compared in Table 2.

UR	MLM HMH | | suaŋ ti	HMH | aŋ ti
Tonal Spreading (or Reduplication)	MLM HMH | `- - -` ǂ suaŋ ti	N/A
Default Insertion	N/A	H HMH | | aŋ ti

Table 2: Rule derivation of (1a) and (1e).

Nevertheless, the motivation that underlies this assumption is only to derive the correct output of Changzhi suffix tone sandhi; no other prediction can be made with the hypothetical rule and representation. The redundancy of the assumption is apparent as well. For example, since verbs cannot be suffixed by both the adjectival and the diminutive suffixes, it is redundant to posit that all the verbs with H are also underlyingly toneless.

Even if we temporarily ignore the above problems, the derivation shown in Table 2 still conflicts with the general tone sandhi patterns shown in Table 1. In Changzhi, H still triggers tone sandhi — for example, /H-H/ → [**HM**-H]. In this case, if H is assigned by the Default Tone rule, the rules of tone sandhi must be ordered after it. The consequence is that the suffixed form in Table 2 must undergo tone sandhi as well. Table 3 demonstrates the failure of the analysis caused by

[2]See Chen (in press) and Duanmu (1994) for the counterarguments against the CTU assumption.

the ordering paradox of the tone sandhi rules and Default Tone rule. The left column represents the derivation of (1e) and the right one represents the derivation of a disyllabic word that presumably has two toneless syllables.

UR	HMH aŋ ti	σ σ
Default Insertion	H HMH aŋ ti	H H σ σ
General Tone Sandhi	* MH HM aŋ ti	HM H σ σ

Table 3: An ordering paradox.

In sum, the rule-based approach, whether CTU based or non-CTU based, requires some arbitrary hypotheses to gain a Pyrrhic victory. Ironically, these arbitrary hypotheses further undermine the analysis with the obvious ordering paradox; an alternative analysis is thus necessary.

3 An Optimality-Theoretic approach to tonal reduplication

3.1 T-RED: A floating tonal reduplicant

Due to the controversy of the CTU and the analytical deficiency of a rule-based analysis, I now turn to a non-CTU-based OT analysis. Following Duanmu (1994), I suggest that the patterns in (1) are results of tonal reduplication. However, tonal reduplication in a constraint-based analysis is completed by satisfying the faithfulness constraints of B(ase)R(eduplicant)-Correspondence, rather than by a sequence of rule applications. But this raises the question of what the reduplicant is or in terms of OT, what the base (equal to 'stem' throughout the paper) tones correspond to. I assume that both the adjectival and the diminutive suffixes are accompanied with a floating tonal reduplicant T-RED as in Figure 3. This assumption follows the fact that reduplicational (e.g., Urbanczyk 2006) and floating tonal (e.g., Hyman to appear) affixes are cross-linguistically common, and T-RED is a mixture of both. One might ask why /ti^{HMH}/ or /tə(ʔ)^{HMH}/ is morphologically necessary when T-RED alone can represent adjectival or diminutive meanings. A possible answer is that /ti/ and /t ə(ʔ)/ serve as TBUs with which the tonal reduplicants can be associated. Otherwise, tonal reduplicants cannot be realized without any host.

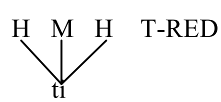

Figure 3: Adjectival suffix with a floating tonal reduplicant.

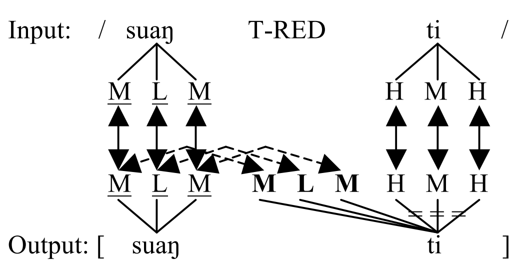

Figure 4: IO-Correspondence (solid arrows) and BR-Correspondence (dashed arrows) of (1a).

Taking (1a) as an example again, IO-Correspondence and BR-Correspondence work together as in

Figure 4 in which base tonemes are underlined and tonal reduplicants are in bold. First, stem tonemes on the stem are reduplicated as tonal reduplicants via BR-Correspondence. Moreover, the tonal reduplicants are associated with the suffix, and the suffix tonemes are deleted due to the crowding effect. In the following section, it will be clear how this model can explain all of the patterns in (1), including (1e) which had been previously treated as exceptional by the rule-based analysis.

3.2 OT analysis

The four OT constraints that are required in my analysis are listed in (2). The OT constraint (2a) is a general faithfulness constraint that is satisfied only when the correspondence between the base and the reduplicated tonemes is faithful. A general markedness constraint that forbids all the tonal phonotactics in Changzhi, and thus triggers tone sandhi as in Table 1, is represented in (2b). The two faithfulness constraints (2c) and (2d), which require the underlying stem/affix tonemes to be preserved in the output, are morphologically conditioned.

(2) a. **FAITH-T-BR**: All correspondences between the base tones and the tonal reduplicant must be faithful (including **MAX-T-BR**, **DEP-T-BR**, **LINEARITY-T-BR**, etc.).
b. **TONALPHONOTACTICS**(**TONALPHON**): *MLM-MLM, *MH-MLM, *MLM-HMH, *MH-HMH, *HMH-HMH, *H-HMH, *HM-HMH, * MLM-H, *MH-H, *HMH-H, *H-H, *H-HM.
c. **MAX-T-IO$_{STEM}$**: Underlying stem tonemes must have a surface correspondence.
d. **MAX-T-IO$_{AFFIX}$**: Underlying affix tonemes must have a surface correspondence.

Two sub-rankings are crucial to the current analysis. First, **FAITH-T-BR** must outrank **TONALPHON** since tonal phonotactics in Changzhi can be violated in the suffixed forms to fully reduplicate the base tonemes. Second, **MAX-T-IO$_{STEM}$** must outrank **MAX-T-IO$_{AFFIX}$** since tonal reduplicants are realized on the suffix rather than the stem. The second sub-ranking is similar to a widely attested root-controlled vowel harmony process.[3] Overall, the constraint ranking of Changzhi suffix tonal reduplication can be generalized in (3).

(3) **FAITH-T-BR** » **TONALPHON** » **MAX-T-IO$_{STEM}$** » **MAX-T-IO$_{AFFIX}$**

MLM MLM ɕi gua	**FAITH-T-BR**	**TONALPHON**	**MAX-T-IO**
a. ☞ MLM H M ɕi gua			**[4]
b. MLM MLM ɕi gua		*!	

Table 4: General tone sandhi /ɕi^{MLM} gua^{MLM}/ → [ɕi^{MLM} gua$^{\mathbf{HM}}$] 'watermelon.'

In a general disyllabic form, since T-RED does not exist, **FAITH-T-BR** does not need to be satisfied and tone sandhi occurs to avoid violating **TONALPHON** as in Table 4. As summarized previously in (2b), two low concave tones MLM are not allowed to be adjacent to each other. Thus, the faithful output candidate (b) in Table 4 is ruled out with a violation of higher-ranked **TONALPHON**. By contrast, the optimal output (a) avoids violating **TONALPHON** by changing the

[3]I appreciate that an anonymous reviewer brought this issue to my attention while reviewing my abstract.

[4]Since there is no distinction between stem and affix, I simplify the two faithfulness constraints by collapsing them into **MAX-T-IO**. Two violations here refer to the deletion of the underlying M and L on the suffix; the insertion of H refers to the violation of **DEP-T-IO**, which I do not demonstrate here.

second underlying tone to a high falling contour tone HM, despite two violations of lower-ranked **MAX-T-IO**.[5]

When a disyllabic form is derived from suffixation, the correspondence between base tonemes and T-RED is evaluated by **FAITH-T-BR**, as shown in Table 5. As in Figure 4, base tonemes are underlined and tonal reduplicants are in bold. The base tonemes of candidate (b) are not faithfully reduplicated to prevent the juxtaposition of two low concave tones. Yet the candidate violates the higher-ranked **FAITH-T-BR** and is therefore ruled out. Notwithstanding the violation of **TONALPHON** with two adjacent MLMs, candidate (a) satisfies **FAITH-T-BR** as optimal.

<u>MLM</u> HMH T-RED suaŋ ti	**FAITH-T-BR**	**TONALPHON**	**MAX-T-IO$_{STEM}$**	**MAX-T-IO$_{AFFIX}$**
a. ☞ <u>MLM</u> **MLM** suaŋ ti		*		***
b. <u>MLM</u> **H M** suaŋ ti	*![6]			***

Table 5: Faithful BR-Correspondence in (1a) /suaŋ^{MLM} ti$^{HMH\ T\text{-}RED}$/ → [suaŋ^{MLM} ti$^{\mathbf{MLM}}$] 'sour.'

The crucial sub-ranking of **MAX-T-IO$_{STEM}$** » **MAX-T-IO$_{AFFIX}$** is also demonstrated in Table 6. The tonal reduplicants of candidate (b) are docked on different syllables by overwriting one stem toneme and two suffix tonemes.[7] With the deletion of one stem toneme, BR-Correspondence is faithful (i.e., <u>ML</u> vs. **ML**) but fatally violates **MAX-T-IO$_{STEM}$**.

<u>MLM</u> HMH T-RED suaŋ ti	**MAX-T-IO$_{STEM}$**	**MAX-T-IO$_{AFFIX}$**
a. ☞ <u>MLM</u> **MLM** suaŋ ti		***
b. <u>ML</u>**M** **L** M suaŋ ti	*!	**

Table 6: Do not overwrite stem tonemes /suaŋ^{MLM} ti$^{HMH\ T\text{-}RED}$/ → [suaŋ^{MLM} ti$^{\mathbf{MLM}}$] 'sour.'

Table 7 presents the analysis of (1b), which is basically identical to that in Table 5. Following the general disyllabic tone sandhi displayed in Table 1, /HMH-HMH/ should change to [MH-HM] after tone sandhi to satisfy **TONALPHON**, as shown by candidate (b). However, BR-Correspondence is not faithful in this case (i.e., a fatal violation of **FAITH-T-BR**).

Table 8 represents the analysis of (1c); in this example, the base tone is a simple contour tone, HM. Since there are only two base tonemes H and M on the stem of candidate (b), only two suffix tonemes have to be overwritten by the tonal reduplicants to satisfy **FAITH-T-BR**. This candidate is nevertheless ruled out due to the violation of **TONALPHON** (i.e., *HM-HMH). In candidate (c), tone sandhi applies and the tonal sequence *HM-HMH is avoided. **FAITH-T-BR** is violated, how-

---

[5]How the tonal sequence is changed to avoid the phonotactics is beyond the scope of this paper, and I assume that other constraints are responsible for selecting the optimal candidate in Table 4 as general disyllabic tone sandhi in Changzhi.

[6]The unfaithful correspondences here are complicated and include linearity and tonal feature changes. It is thus simplified by portraying it as a single violation that is sufficient to rule out non-optimal candidates.

[7]Two Hs on the suffix are deleted to avoid some unusual tonal sequences, such as LMH or HML. LM is also not a lexical tone in Changzhi, a fact that should thus violate **TONALPHON**; the example is made up here for the purpose of demonstration.

ever, because the base tonemes and the tonal reduplicants have different linear orders. Thus, the optimal solution is the deletion of all suffix tonemes as shown by candidate (a).

HMH HMH T-RED yaŋ ti	**FAITH-T-BR**	**TONALPHON**	**MAX-T-IO$_{STEM}$**	**MAX-T-IO$_{AFFIX}$**
a. ☞ HMH **HMH** yaŋ ti		*		***
b. M H **H M** yaŋ ti	*!		*	***

Table 7: (1b) /yaŋ^{HMH} ti$^{HMH\ T\text{-}RED}$/ → [yaŋ^{HMH} ti^{HMH}] 'soft.'

H M HMH T-RED laŋ ti	**FAITH-T-BR**	**TONALPHON**	**MAX-T-IO$_{STEM}$**	**MAX-T-IO$_{AFFIX}$**
a. ☞ H M **H M** laŋ ti				***
b. H M **HM**H laŋ ti		*!		**
c. M H **H M** laŋ ti	*!			***

Table 8: (1c) /laŋ^{HM} ti$^{HMH\ T\text{-}RED}$/ → [laŋ^{HM} ti$^{\mathbf{HM}}$] 'rotten.'

The analysis of (1d) is identical to that of (1c) since the base tone is also a simple contour tone MH that is composed of two tonemes. Candidate (b) also violates **TONALPHON** with the tonal sequence MH-HMH and candidate (c) fatally violates **FAITH-T-BR** with the application of tone sandhi to avoid the tonal phonotactic *MH-HMH.

M H HMH T-RED xuaŋ ti	**FAITH-T-BR**	**TONALPHON**	**MAX-T-IO$_{STEM}$**	**MAX-T-IO$_{AFFIX}$**
a. ☞ M H **M H** xuaŋ ti				***
b. M H H**MH** xuaŋ ti		*!		**
c. M H **H M** xuaŋ ti	*!			***

Table 9: (1d) /xuaŋ^{MH} ti^{HMH}/ → [xuaŋ^{MH} ti$^{\mathbf{MH}}$] 'yellow.'

The above analysis answers the first question presented at the outset of this paper: Why can tonal phonotactics be violated in the suffix forms? We can now return to the remaining question: Why does the base tone H on the stem not overwrite all suffix tonemes? Compare candidate (a) to candidates (c) and (d) in Table 10; all of them violate **TONALPHON** since *H-HMH, *H-HM, and *H-H are tonal phonotactics in Changzhi. The two candidates do not violate **FAITH-T-BR** because the base tone H on the stem is reduplicated onto the suffix. Thus, the crucial difference lies in the number of suffix tonemes that are overwritten by the tonal reduplicant. In other words, only the first suffix toneme of candidate (a) is overwritten, which results in one violation of **MAX-T-IO$_{AFFIX}$**. Candidate (c) and (d), on the other hand, violate **MAX-T-IO$_{AFFIX}$** two and three times, respectively, by deleting two or all of the suffix tonemes. This difference clearly demonstrates the fact that candidate (a) is more harmonic than candidate (c) and (d); if the base tone on the stem can be fully reduplicated onto the suffix by overwriting just one suffix toneme (i.e., candidate (a)), it is unnecessary to delete more suffix tonemes (i.e., candidate (c) and (d)). As the surface tonal sequence is identical to the input, Duanmu (1994) and Yip (1989) viewed (1e) as an underapplication of tonal reduplication/spreading. I suggest, however, that tonal reduplicantion indeed occurs in (1e), but *covertly*.

Yet candidate (b) in Table 10 is even more harmonic than candidate (a), of which one more suffix toneme is additionally deleted to avoid the tonal phonotactic *H-HMH as in Table 8 and 9. I suggest that candidate (b) is ruled out by **LOCALITY** (Nelson 2003) that is higher-ranked and requires the reduplicant to be adjacent to its base.[8] Candidate (b) violates this constraint because the left suffix toneme M intervenes between the base H̲ and the tonal reduplicant **H**. This analysis is fully illustrated in Table 11.

H̲ HMH T-RED / aŋ ti	**FAITH-T-BR**	**TONALPHON**	**MAX-T-IO$_{STEM}$**	**MAX-T-IO$_{AFFIX}$**
a. ☞ H̲ **H** M H / aŋ ti		*		*
b. 💣 H̲ M **H** / aŋ ti				**
c. H̲ **H** M / aŋ ti		*		**!
d. H̲ **H** / aŋ ti		*		**!*

Table 10: (1e) /aŋ^{H} ti$^{HMH\ T\text{-}RED}$/ → [aŋ^{H} ti^{HMH}]

H̲ HMH T-RED / aŋ ti	**LOCALITY**	**TONALPHON**
a. ☞ H̲ **H** M H / aŋ ti		*
b. H̲ M **H** / aŋ ti	*!	

Table 11: Locality effect in (1e).

In the course of this section, I have rendered the concept of tonal reduplication from Duanmu (1994) and improved Duanmu's analysis by utilizing an OT model of BR-Correspondence with a floating tonal reduplicant T-RED. Since earlier rule-based analyses treat (1e) as an exception to the rule-application, a few arbitrary assumptions, which are in fact problematic as stated in section 2.3, must be proposed to explain this exception. Instead, I argue that the reduplication is evaluated universally by BR-Correspondence, including (1e). The question thus becomes why the tonal sequence remains unchanged after tonal reduplication, which has been answered in this section.

[8] It is possible to argue that candidate (b) in Table 9 is ruled out by this constraint as well.

One might ask whether the OT analysis presented above can be translated back to the rule-based approach with a cyclic rule application.[9] That is, based on Duanmu's approach in section 2.2, the delink rule and the reduplication rule recursively apply to one single toneme once at a time. The problem here is how to define rules that can copy and delete different tonemes in different cycles of rule application. Moreover, since the reduplication rule is separate from the deletion (of suffix tonemes) rule, the latter should no longer apply when there is not any base toneme left to be copied. I believe that this is computationally feasible and may be theoretically acceptable, but with its parallelism and without the computational complexity, OT is more advantageous in dealing with the reduplication patterns.

4 'Total' and 'tonal' reduplication

One counterargument from Yip (1995) against the reduplication proposal in this paper and the one in Duanmu (1994) is that the patterns of *total* (verbal) reduplication are totally different from (1). As shown in (4), when the stem is followed by a total reduplicant, tone sandhi still applies and changes the surface tonal sequences. The question raised by the data in (4) is this: if the base tones are not fully reduplicated in total reduplication, then why does it occur in the suffix forms?

(4)	a. saŋ^{MLM}	+	RED	→	saŋ^{MLM} saŋ$^{\mathbf{MH}}$	'fan'
	b. tuŋ^{HM}	+	RED	→	tuŋ$^{\mathbf{MH}}$ tuŋ$^{\mathbf{HM}}$	'move'
	c. ts'ɔ^{HMH}	+	RED	→	ts'ɔ^{HMH} ts'ɔ$^{\mathbf{MH}}$	'fry'
	d. tç'iəu^{MH}	+	RED	→	tç'iəu^{MH} tç'iəu$^{\mathbf{HM}}$	'ask for, beg'
	e. suaŋ^{H}	+	RED	→	suaŋ$^{\mathbf{ML}}$ suaŋ$^{\mathbf{HM}}$	'count'

Yet Duanmu specifies that the reduplication rule in his approach is *morpheme-specific*, and it should be noted that the patterns in (4) represent another different morpheme (i.e., verbal reduplication). Thus, a straightforward explanation for the difference in terms of a rule-based analysis is that the rules applying to the patterns in (1) and (4) are different. In terms of the OT analysis proposed in this paper, I suggest that the effects of the different morphological contexts can be represented by morphologically-indexed faithfulness constraints (Pater 2000, 2009).

Since these constraints can be indexed to a morphological category (or even to a specific lexical item), we can separate **FAITH-T-BR** into **FAITH-T-BR$_{\mathbf{RED}}$** and **FAITH-T-BR$_{\mathbf{T\text{-}RED}}$**. The former requires the base tonemes in (4) to be reduplicated faithfully, and the latter requires those in (1) to be fully copied. Supposing that tone sandhi applies in (4) to avoid some tonal phonotactics as well, **TONALPHON** must outrank **FAITH-T-BR$_{\mathbf{RED}}$** for tone sandhi to apply. On the other hand, **FAITH-T-BR$_{\mathbf{T\text{-}RED}}$** outranks **TONALPHON** to maintain faithful BR-Correspondence, as the analyses in section 3 show. This ranking can be simply summarized in (5).

(5) **FAITH-T-BR$_{\mathbf{T\text{-}RED}}$** » **TONALPHON** » **FAITH-T-BR$_{\mathbf{RED}}$**

Another possible and deeper solution to this difference is to argue that reduplication at the segmental and suprasegmental levels is evaluated by **FAITH-BR**, which is satisfied by fully reduplicating either segments or tonemes of the base. In other words, since the full reduplication is already realized at one of the two levels, why is it necessary to represent the full reduplication at both levels? Many Chinese dialects have the patterns similar to (4), in which tone sandhi occurs after total reduplication. The famous Third Tone Sandhi rule in Standard Mandarin, for example, changes Tone III (MLH) to Tone II (MH) before another Tone III, which also applies in total reduplication as in (6).

(6)	a. tsʰai^{MLH} + RED	→	tsʰai$^{\mathbf{MH}}$ tsʰai^{MLH}	'step on'
	b. tʰaŋ^{MLH} + RED	→	tʰaŋ$^{\mathbf{MH}}$ tʰaŋ^{MLH}	'lay down'
	c. ta^{MLH} + RED	→	ta$^{\mathbf{MH}}$ ta^{MLH}	'beat'

With this proposal, the difference between (1) and (4) lies in whether there are multiple phonological levels to realize the complete reduplication. In (1), the base tonemes must be reduplicat-

[9] I thank Kyle Gorman for introducing this question into the discussion.

ed faithfully because T-RED only represents the reduplicants at the suprasegmental level. Any difference between the base and T-RED leads to unfaithful reduplication. In (4), RED represents a reduplication process at both segmental and suprasegmental levels; it is now possible to realize faithful reduplication at either level. A question about this approach in terms of typology is whether there is any tone language that has faithful reduplication at the suprasegmental level but unfaithful reduplication at the segmental level in total reduplication. I will leave this approach open for the further discussion.

5 Concluding remarks

In this paper, I have briefly discussed tonal reduplication in the suffixed forms of Changzhi. Previous rule-based analyses were trapped by the puzzle of why the rule of tonal spreading or reduplication did not apply when the tone on the stem was H. More arbitrary assumptions such as tonal underspecification and default tone insertion could provide a few descriptive explanations, but they were incompatible with general tone sandhi patterns.

Conversely, I suggest that we should look at the patterns from a different angle and ask why the output tonal sequence remains unchanged after tonal reduplication. Since there is no exception in this approach (i.e., every suffixed form is reduplication), we are able to provide a wider generalization of the suffix tone sandhi patterns in Changzhi. Finally, the proposal of the tonal reduplicant T-RED will be more solid if one can discover other examples in different tone languages. Yet it is reasonable to remain optimistic since tonal phonology should be able to do what segmental phonology does (Hyman to appear:484). That is, with the segmental reduplicants widely attested, it is plausible to expect typological evidence of the tonal counterparts.

References

Chen, Tsung-Ying. 2010. Some remarks on contour tone units. *Journal of East Asian Linguistics* 19:103–135.

Duanmu, San. 1994. Against contour tone units. *Linguistic Inquiry* 25:555–608.

Goldsmith, John. 1976. Autosegmental Phonology. Doctoral Dissertation, MIT.

Hou, Jingyi. 1983. Changzhi fangyan jilu (Notes on the Changzhi dialect). *Fangyan* 1983:260–274.

Hyman, Larry. To appear. Tone: Is it different?, In *The Handbook of Phonological Theory*, 2nd Edition, ed. John Goldsmith, Jason Riggle and Alan Yu.

McCarthy, John, and Alan Prince. 1994. The emergence of the unmarked: Optimality in prosodic morphology. In *Proceedings of NELS 24*, 333–379. GLSA, Amherst, MA.

McCarthy, John, and Alan Prince. 1995. Faithfulness and reduplicative identity. *University of Massachusetts Occasional Working Papers in Linguistics 18: Papers in Optimality Theory*, 249–384.

Nelson, Nicole. 2003. Asymmetric Anchoring. Doctoral Dissertation, Rutgers University.

Pater, Joe. 2000. Nonuniformity in English stress: the role of ranked and lexically specific constraints. *Phonology* 17: 237–274.

Pater, Joe. 2009. Morpheme-specific phonology: Constraint indexation and inconsistency resolution. In *Phonological Argumentation: Essays on Evidence and Motivation*, ed. Steve Parker, 123–154. London, UK: Equinox.

Prince, Alan, and Paul Smolensky. 2004. *Optimality Theory: constraint interaction in generative grammar*. Oxford, UK: Blackwell.

Urbanczyk, Suzanne. 2006. Reduplication. In *The Cambridge Handbook of Phonology*, ed. Paul de Lacy, 473–494. Oxford, UK: Cambridge University Press.

Yip, Moira. 1989. Contour tones. *Phonology* 6:149–174.

Yip, Moira. 1995. Tone in East Asian Languages. In *The Handbook of Phonological Theory*, 1st Edition, ed. John Goldsmith, 476–494. Oxford, UK: Blackwell.

Department of Linguistics
University of Alberta
4-32, Assiniboia Hall
AB, Canada T6G 2E7
tsungyin@ualberta.ca