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Feng-fan Hsieh*

1 Introduction

This paper proposes that certain attested instances of tone sandhi are *not* driven by well-formedness conditions, e.g. tonal chain-shifts found in Southern Min (SM), a language group in the Min branch of Sinitic languages, in particular, Coastal Taiwanese (CT) and Mainstream Taiwanese (MT; the famous "tone circle"). As extensively discussed in the literature, SM tonal chain-shifts are notorious in that (i) the alternations often have no phonotactic motivations, (ii) the alternations are not always predictable, and (iii) the chain-shifts may be circular, e.g. A → B → A. Circular chain shifts cannot be handled in Classical OT, as Moreton (1999) has convincingly argued. Therefore, there is a general consensus that SM tone sandhi rules are arbitrary and idiosyncratic. I contend that, on the contrary, tone chains can be captured in OT by appropriate ranking of well-motivated phonetically-driven constraints and anti-merger constraints militating against syncretism in a tonal paradigm.

The paper is organized as follows. Section 2 provides background knowledge, as well as criticisms of previous analyses. Section 3 offers my analysis of tone chains in CT and MT. In section 4, I will show that the present analysis does shed light on the interpretation of results of previous experiments and is capable of explaining why Taiwanese tone chains seem to lack psychological reality. Finally, section 5 concludes the paper.

2 Setting the Stage

2.1 Right Prominence

In SM dialects, tone sandhi shows *Right Prominence*, i.e. it takes place in an internal position of a phonological phrase[1] (P-Phrase), as shown below.

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[1]That is termed a "Tone Group" in Chen (1987). For competing definitions of P-Phrase in Taiwanese/Xiamen Chinese, see Chen (1987, 2000) and Lin (1994).

(1) $[TT...T]_{P\text{-}Phrase} \rightarrow [T'T'...T]_{P\text{-}Phrase}$
(T=citation tone; T'=sandhi tone)

The tone sandhi patterns are illustrated in section 3. In addition, citation tones can appear phrase-internally if and only if the final syllable of phrase is occupied by a function word or is unstressed. Observe the following contrast. (o=unstressed syllable)

(2) a. Function word, e.g. sentence-final particle
[lim cit-pue a]$_{P\text{-}Phrase}$ [T'.T'.T.o]$_{P\text{-}Phrase}$
drink one-glass PERFECTIVE 'drank one glass (e.g. of wine)'
b. Grammatically-conditioned stress, e.g. indefinite phrase
[lim cit-pue]$_{P\text{-}Phrase}$ [T.o.o]$_{P\text{-}Phrase}$
drink one-glass 'drink something'

2.2 Quandaries with Previous Analyses of Tone Chains

In rule-based frameworks, there are generally three diagnoses of Taiwanese tone chains, namely, (i) *feature-exchange rules* (Wang, 1967; Cheng, 1968; Shih, 1986); (ii) *autosegmental processes* (Yip; 1980; Wright, 1983; Du, 1988; Bao, 1999; to name only a few); and (iii) *paradigmatic replacements* (Schuh, 1978), as is summarized in Moreton (1999). For reason of space, I cannot review these analyses in detail. However, these analyses fail to explain several essential properties of SM tonal chain-shifts. First, they do not address what could possibly *trigger* those chain-shifts. This is particularly problematic in an autosegmental approach, since this type of tone sandhi demonstrates a drastically non-local relationship. Secondly, a satisfactory account for Right Prominence (see (1)) is difficult to attain with these analyses because a "perfect" mirror image of SM tone sandhi is cross-linguistically unattested[2]. Incidentally, this observation is equally problematic if we adopt a positional faithfulness approach[3].

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[2]By a "perfect" mirror image, I mean the cases in which tone sandhi takes place in a *non*-initial position of a P-Phrase and citation tones are *all* faithfully realized on phrase-initial syllables. Obviously, tonal phenomena in the Wu language group, e.g. Shanghai Chinese, cannot be subsumed into this category.

[3]In a recent OT analysis of Taiwanese tone sandhi, Hsiao (2000) proposes the following ranking of constraints to derive Right Prominence.

IDENT-TONE-RIGHT » T^2D (No two citation tones in a tone sandhi domain) // IDENT-TONE-LEFT // IDENT-TONE

However, if that is correct, it is not clear why the other possibility, i.e. Left/Initial Prominence, does not seem to exist.

The issue of psychological reality constitutes another challenge. Hsieh (1970, et seq.) and Wang (1995) report that nonce words are often not subjected to appropriate tone sandhi rules by native speakers in experiment settings. Error rates range from 50% to 75%. However, it is also evident that Japanese loanwords into Taiwanese and newly coined lexical items do participate in the tonal chain-shifts, as is pointed out in Wang (1995). It is again unclear how a "unified" analysis can accommodate these conflicting facts.

Most importantly, there seems to be *real* productive tone sandhi distinct from the well-known chain shifts, according to informal *wug*-tests I have conducted for tone sandhi rules in *a*-suffix (the counterpart of *r*-suffix in Mandarin Chinese). All of the subjects (Number=3) successfully apply the following tone sandhi rules when non-real words used in Hsieh (1970, et seq.) and Wang (1995) are suffixed.

(3) a. H/M/LM → M /__*a*-suffix
b. L/HL → H /__*a*-suffix

As an interim summary, it should be safe to claim that tonal chain-shifts and the tone sandhi rules in (3) should be generated by very different computation than those available in previous analyses.

To capture the fact that Taiwanese tone sandhi seems to lack productivity, Tsay and Myers (1996) propose that "Taiwanese tone sandhi refers to a tonal phenomenon where every morpheme has two alternating tones, one showing up in *juncture* position (including in citation), the other showing up in *context* position..." In short, they treat tone chains as "allomorph selection." This approach is problematic in that (i) if "allomorphy is not generated," it is not clear why loanwords and newly coined lexical items participate in tone chains, (ii) juncture and context positions are not always determined by syntax. Stress plays an important role in the appearance of citation/sandhi tones (see (2)), and (iii) assuming that allomorphs are listed arbitrarily, e.g. {si^{H}; si^{M}} 'poem', because "*H*→*M* in sandhi," it is, then, unclear why in a *monomorphemic polysyllabic* word like [$\sigma^{H}\sigma^{M}$], the actual sandhi form is [$\sigma^{M}\sigma^{L}$] but not, say, [$\sigma^{L}\sigma^{HL}$]. In addition, if "every morpheme has two alternating tones," then we should not expect that every tone undergoes tone sandhi in a monomorphemic polysyllabic word.

Finally, Yip (2001, 2002) offers an OT analysis on tonal chain-shifts in an SM dialect Chaoyang. Under her Dispersion-theoretic analysis, various "mini-grammars" constrain the tonal inventories in different positions. Again, it does not seem to fare better in clarifying the puzzles as to what triggers the tone chains and why Right Prominence is motivated.

In the following sections, our goals are to answer the questions we

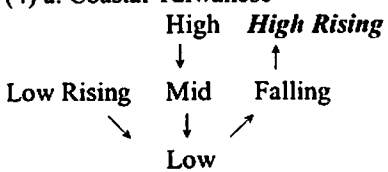
have so far, namely, (i) what motivates tonal chain-shifts, (ii) why is Right Prominence attested, and (iii) how do we explain the "semi-productivity" of tone chains? In addition, how do we cope with the fact that there seem to be two types of tone sandhi in terms of productivity (i.e. tone chains versus tone sandhi of *a*-suffix in (3))?

3 The Analysis

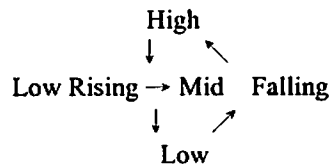
The core data are illustrated below. Note that checked tones are not included and will not be discussed in this paper for reasons of space. To the best of my knowledge, there is *no* substantial difference between checked tones and non-checked tones in terms of chain-shifts.

(4a) shows chains in CT. Notice that the high rising tone in (4a) is ***not*** a citation tone. (4b) illustrates the Tone Circle of MT (or Xiamen Chinese).

(4) a. Coastal Taiwanese



b. Mainstream Taiwanese



3.1 The Triggers of Tone Chains

To begin our discussion, I propose that the **Contour Tone Licensing Condition** serves as the first trigger. I argue that Right Prominence is motivated by a well-known prosodic fact, "Phrase-final Lengthening." According to Peng (1996), phrase-internal syllables are 40% shorter than phrase-final syllables. Therefore, a phonetically-driven constraint MAX-(TONE)$_{\text{LONGER-SYLLABLE}}$[4] can be proposed. Given that tonal markedness constraints are always outranked, such as, for instance, the anti-contour-tone constraint, Right Prominence is expected. For example, a low rising tone is not allowed in sandhi positions because it takes longest to produce this tone. In addition, this also predicts the absence of an Initial/Left Prominence system because "Phrase-initial Lengthening" does not seem to be a possible prosodic effect without the involvement of other factors. The above discussions can be demonstrated in the tableau below. Note that T_C=contour tone; T_L'=leveled

[4]Notice that this constraint is applicable to a stressed syllable as well, because it is a well-established fact that duration also serves as a key correlate of stress. See also the contrast in (2).

contour tone.

(5) Deriving Right Prominence and contour tone simplification

$[T_C T_C T_C]_{P\text{-}Phrase}$	MAX-(TONE)$_{LOWER\text{-}STEP}$	*CONTOUR-TONE	MAX-(TONE)
☞a. $[T_L{}'T_L{}'T_C]_{P\text{-}Phrase}$		*	**
b. $[T_C T_C T_C]_{P\text{-}Phrase}$		***!	
c. $[T_C T_C T_L{}']_{P\text{-}Phrase}$	*!	**	*

Second, I argue that the *Lowering of High-registered tones in non-prominent positions* (i.e. phrase-internal positions) also plays a crucial role in the formation of the chains. It has been observed that prominent positions and higher tones have an affinity for each other (cf. Tone-Accent Attraction Condition in Goldsmith, 1987). De Lacy (2002) further proposes that *non-heads* (roughly corresponding to our non-prominent positions) and lower tones have an affinity for each other as well. In SM, there is a preference for Low-registered tones in non-prominent positions. Descriptively, we may say that H-register tones, as perceptually salient tones, are not compatible with non-prominent positions. The most significant evidence is the fact that the high level tone is banned from surfacing in sandhi forms in CT. Furthermore, the present analysis also predicts that we do *not* expect "Raising of Low-registered tones in non-prominent positions." That is, in a language L, the Low tone is disallowed in non-prominent positions, which then triggers tonal chain-shifts. To the best of my knowledge, there does not seem to be an attested language with these properties. Armed with these tools, the following sections are devoted to analytical issues of the tone chains.

3.2 A Formal Analysis of Chain-shifts

In this paper, I assume that tonal chain-shifts are driven by avoidance of neutralization in a tonal paradigm (or *contrast preservation* in Lubowicz (2003)); see Kirchner (1996) for a different take. In this paper, I adopt the anti-merger constraint family, the Systemic Faithfulness constraint in Padgett (2003), which is in turn based on Dispersion Theory developed in Flemming (1995). The definition of an anti-tonal-merger constraint is given as follows.

(6) *Merge (Tone)
Assign a violation to the *output-and-output* mapping such as,
$[T_1, T_2]_X \rightarrow [T_{1,2}]_Y$

Suppose that in Environment X, we observe that a high tone and a mid

tone, being contrastive in Environment Y, become non-distinctive, for instance, a mid tone. In this case, it incurs a violation of (6). The toy tableau in (7) exemplifies the mechanism. For ease of discussion, let us assume that somehow Rising must become Mid to satisfy *CONTOUR-TONE, and Mid somehow has to shift to Low tone to eschew punishment of *MERGE-(TONE). The tableau in (7) demonstrates how chain-shifts are motivated in our analysis. Notice that T=any tone, R=Rising, M=Mid, and L=Low.

(7) Motivating chain-shifts

$[R_1.T]_{P\text{-}Phrase}$ $[M_2.T]_{P\text{-}Phrase}$	MAX-(TONE)$_{LONGER\text{-}SYLL}$	*MERGE (TONE)	*CONTOUR-TONE	IDENT-OO-(TONE)
a. $[M_{1,2}.T]_{P\text{-}Phrase}$		*!		*
b. $[R_1.T]_{P\text{-}Phrase}$ $[M_2.T]_{P\text{-}Phrase}$			*!	
☞c. $[M_1.T]_{P\text{-}Phrase}$ $[L_2.T]_{P\text{-}Phrase}$				**

This tableau should be quite straightforward. (7a) is penalized by the anti-merger constraint while (7b) avoids tonal neutralization but is still ruled-out due to the high-ranked anti-contour-tone constraint. Candidate (7c) is therefore selected as the winner. In sum, the gist of our analysis is that tone chains are first triggered by phonetically-motivated factors; that is, phrase-internal syllables are "not-so-good" as hosts of contour tones because of their comparatively short duration, and non-prominent positions tend to induce lowering of H-registered tones. It follows that tonal neutralization is inevitable in non-final positions. By appropriate ranking of specific anti-merger constraints, the attested sandhi patterns can be derived. The following sections are thus devoted to test the aforementioned diagnoses by examining two varieties of Taiwanese: CT and MT.

3.3 Coastal Taiwanese

Recall (4a). High level tone and Low rising tone are both absent in sandhi positions in CT. Markedness constraints penalizing the two tones should be eligible motivations for tone chains. As first approximation, (8) depicts how tonal chain-shifts should be triggered.

(8) a. High tone is banned in non-final positions:
H→M→L→HM →MH

b. Low rising tone must undergo leveling:
LM→L

This naïve assumption must be further elaborated, of course. First, why does H not shift to L in sandhi forms? This is not a trivial issue because this kind of mapping is attested in Chaoyang, another Southern Min dialect (Yip 2001, 2002). I argue that H → L' violates PERCEPTION-FAITH (or Donca Steriade's P-map). In Peng (1997), it has been shown that M is *evenly* dispersed between H and L. Thus, I assume the perceptual space below. With (9), let us now look at the following tableau to see how it works.

(9) Perceptual space: H...M...L
1...1/2...0

(10) The effect of PERCEPTION-FAITH

	*SANDHI-HIGH	PERCEPTION-FAITH ≤ 1/2
a. H → L'		*!
☞b. H → M'		

(T=citation tone; T'=sandhi tone)

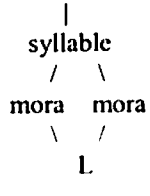
Note that "*SANDHI-HIGH" is simply a shorthand representation of the combined constraints we discussed earlier. The above tableau demonstrates that H → L' is dispreferred because there is still a perceptually more faithful mapping, i.e. the actual one, H → M'.

Second, we have to answer a more challenging question: Why does H not change to HM or MH to satisfy *H? By contrast, why does L become HM, but not MH? In other words, we know that high tone becomes mid while low shifts to falling. But how do we rule out contrariwise mappings?

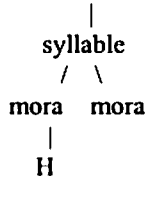
Here I adopt the system of tonal representation proposed in Yip (2001). Her basic claim is that level tones have two phonetic targets, whereas contour tones may have zero, one, or two phonetic targets depending on language-specific properties. Details aside, let us assume that contour tones in Taiwanese have only an initial phonetic target, i.e. only the initial mora is associated with a toneme. The representations of a level tone and a contour tone are illustrated in (11a) and (11b) respectively.

(11) Sample representations of level and contour tones

a. Low: [L-Register]



b. High falling: [H-Register]



With this in mind, let us turn to look at the tableau below. (12a) is a promising candidate because no H occurs in sandhi positions, as we expect. However, if the sandhi form of H is a falling tone, then it is obvious that the second phonetic target is not preserved. IDENT-OO-2NDMORA-(LINK) aims at banning a mapping like (12a). Note that Register specifications are not marked out: we consider only H-registered tones here.

(12) Preservation of the final phonetic target

	*SANDHI-HIGH	IDENT-OO-2NDMORA-(LINK)	IDENT-OO-(TONE)
a. μ μ → μ μ V / H H		*!	
☞b. μ μ → μ μ V V H L			*

If we rank IDENT-OO-2NDMORA-(LINK) over IDENT-OO-(TONE), then the real forms are what we expected, as shown above. By contrast, we still have to explain why L doesn't change to one of the other level tones, in particular, M. It is a easy question, because we know that M is not target of neutralization in CT. However, a non-trivial problem does arise. Consider (13a). This candidate should be the most "natural" outcome if L is forced to change. Importantly, high rising tone *is* allowed in this dialect. Here the two candidates get tied at the IDENT-LINK constraint. (13b) wins because of fewer L-toned moras. In other words, H-toned moras are by default preferred.

(13) H → M → L → *Falling or Rising*?

	IDENT-OO-2NDMORA-(LINK)	*L-MORA	*H-MORA
a. μ μ → μ μ V / L L	*	***!	
☞b. μ μ → μ μ V / L H	*	**	*

Let us turn now to deal with tone chains in CT. See the tableau in (14). *H and *LM are top-ranked as the "triggers." To satisfy these two markedness constraints, H goes to M and LM is simplified to L in (14b). However, if M remains M in sandhi, then a fatal violation of *MERGE (M) is incurred. As we know, M is *not* the target of neutralization in CT. In (14c), M shifts to

L in order to avoid the previous failure, but it does not fare better because in this case there are too many neutralizations of L. Therefore, as we discussed earlier, L changes to F and then F has to become a non-lexical high rising tone. This is exactly what we have in (14a), the optimal candidate. In sum, the present ranking of constraints successfully predicts the tone sandhi patterns in CT.

(14) Tone chains in Coastal Taiwanese

	*H	*LM	*MERGE (M)	*MERGE (TONE)
☞a. H → M M → L L → HM HM → MH LM → L				*
b. H → M M → M L → L HM → HM LM → L			*!	**
c. H → M M → L L → L HM → HM LM → L				***!

3.4 The Tone Circle in Mainstream Taiwanese

In MT, there is no denying that the mechanisms of the famous Tone Circle do share affinities with the tone chain in CT. For example, MT takes a "further" step in preventing a rising tone, be it H-registered or L-registered, from surviving in non-final positions. However, an analogical diagnosis seems to be difficult to come by for the case at hand. Unlike CT, H *is* found in sandhi tones of MT. In other words, the top-ranked *H in CT grammar cannot be directly treated as one of the triggers in MT. One plausible conjecture is that although a sandhi H is tolerated in MT grammar (presumably a diachronic repair strategy to the *non-lexical* high rising tone; I shall return to this point later), the number of H-registered tones tends to be minimized in sandhi contexts. This is what we call the "Lowering-of-H-registered-tones" effect. If it is on the right track, we then want to ask: how can we allow H-registered tones to lower to L-register and at the same time, allow L-registered tones to "bounce" back to H-register in order to avoid tonal

neutralization? The *antifaithfulness* constraint proposed in Alderete (2001) is an eligible tool to do this. The formulation of this constraint is given in (15). Notice again that we are always talking about tonal mappings from citation (prominent) positions to sandhi (non-prominent) positions. According to this constraint, if a H-registered tone in Environment X (i.e. citation) retains its register specification in Environment Y (i.e. sandhi), then our new constraint will penalize a mapping of this sort.

(15) ¬ Ident-OO-(H-Register)
Assign a violation when High register specification of a syllable in Environment 1 is identical with that in Environment 2.
I.e.:
Satisfied: H-register → L-register, L-register → H- or L-register
Violated: H-register → H-register

To be more explicit, I assume that register specifications of tones in MT (as well as CT) are as follows. Notice that this assumption is based on the phenomena of *a*-suffix tone sandhi, as demonstrated in (3). It should be evident that only *H* and *M* are allowed in a *a*-suffixed stem. In other words, M patterns with H and therefore should be affiliated with H-register. (16) summarizes the register specifications of long tones.

(16) a. H-registered tones: {H, M, F}
b. Low-registered tones: {Low Rising, L}

That being the case, our analysis of the Tone Circle proceeds as follows. First, *RISE should be top-ranked because apparently no rising tone is allowed in MT sandhi tones. Additionally, M can be neutralized (recall (4b)). To do this, we have to rank anti-merger (H) and (L) over the anti-tonal-merger constraint. For reasons of space, it is not possible to examine all of the serious candidates. However, we cannot neglect a very plausible one, (17b). Because in MT there is only one "overt" trigger, i.e. simplification of the Low Rising tone (LR), it may well be the case that no further chain-shifts are motivated. At this point, our antifaithfulness constraint becomes crucial in determining the optimal candidate.

In (17a), we observe two *H-register→H-register* mappings, that is, {H→M, F→H}, while there are 3 in (17b): {H→H, M→M, F→F}. Crucially, we also need to rank the anti-merger constraints higher than the antifaithfulness constraints because ideally tonal neutralization must be minimal. (17a) is therefore selected as the optimal output form.

(17) The Tone Circle in Mainstream Taiwanese/Xiamen Chinese

	*RISE	*MERGE (L)	*MERGE (H)	*MERGE (TONE)	¬ IDENT-OO- (H-REGISTER)
☞ a. **H → M** M → L L → F **F → H** LR → M				*	**
b. **H → H** **M → M** L → L **F → F** LR → M				*	***!

Incidentally, according to a long-term sociolinguistic investigation on language change in Taiwanese (Ang 2003), the distinctive traits in CT tone sandhi, i.e. "*Falling → High Rising*" and "*Low Rising → Low*," have been lost amongst young speakers of this variety.

(18) a. Citation falling tone becomes high in sandhi,
b. Citation low rising tone changes to mid tone in sandhi.

It is therefore reasonable to conjecture that the circular tonal chain-shifts we have in MT might have undergone a very similar evolutionary process. In other words, the (non-lexical) high rising tone in sandhi[5], as a "marked" tone, is the most "vulnerable" one with respect to language change. This is a plausible explanation of the diachronic evolution of the Tone Circle. However, it is also true that learners of MT (or Xiamen Chinese) are *not* aware of these facts. So it seems to be problematic to claim that in a way the Tone Circle is a kind of phonologization, or "paradigmatic replacements" as proposed in Schuh (1978). I have shown that tone chains, at least in SM dialects, are *not* arbitrary and idiosyncratic at all. Furthermore, as mentioned earlier, if this is correct, we would not explain why native speakers did so poorly in experimental settings. Instead, it is very likely that tonal chain-shifts are generated by computation of the grammar. To conclude, the formation of the Tone

[5]MT, or Xiamen Chinese, was allegedly formed by merger of *Quanzhou* and *Zhangzhou* dialects. Interestingly, in both dialects, we do observe a *non-lexical* high-rising tone in sandhi. Coastal Taiwanese is a *Quanzhou*-accented variety. The reader is referred to the sandhi patterns in *Longxi*, a *Zhangzhou* variety cited in Chen (2000).

Circle should be driven by promotion of the antifaithfulness constraint on tonal register specifications while tonal markedness constraints are demoted.

4 Psychological Reality of Tonal Chain-shifts

In previous experimental studies, the results indicate that tone chains do not seem to be psychologically real. How do we interpret these puzzling results in light of our analysis?

Importantly, the nonce words in previous studies were created in two different ways. Hsieh (1970, et seq.) created nonce words that fill a *tonotactic gap* in MT. For instance, he uses a non-real word like {tui^{HL}} as one of the stimuli, while the other tonal forms are real words, i.e. {tui^{H}, tui^{M}, tui^{L}, tui^{LM}}. The problem native speakers have in this study may be attributed to this: if $tui^{HL} \rightarrow tui^{H}$ in sandhi, subjects may try to avoid this situation, that is, the real word tui^{H} (homophonous with the expected sandhi tone) occurs in sandhi position.[6] Therefore, subjects tend not to apply tone sandhi rules, basically in accordance with the results of Hsieh (1970, et seq.), that is, 90%-70% errors (depending on the individual) are classified as "*non-application* of tone sandhi rules".

On the other hand, in Wang (1995), the nonce words fill a *phonotactic* gap. That is, segmental combinations do not occur as real words, e.g. $bi\text{-}ang^{HL}$. To interpret Wang's results, remember that our analysis requires computation over a set of candidates, *not* a single token. That predicts the lack of tone sandhi in the nonce words, since in these cases, there is no suitable set of candidates for purposes of computation and comparison. Therefore, the speaker cannot arrive at the correct tone sandhi form.

5 Concluding remarks

To conclude, this paper raises the following points.

(i) Tonal chain-shifts are *not* driven by phonotactic or well-formedness concerns. Rather, avoidance of tonal neutralization serves as the major motivation for tonal chain-shift in Southern Min.

(ii) Right Prominence is due to Phrase-final Lengthening. In addition, I

[6]This explanation predicts if we have a nonce word (which fills in a tonotactic gap) such as {ba^{H}}, we should expect significantly frequent successful applications of this tone sandhi rule ($H \rightarrow M$ in sandhi) because M is the target of neutralization in MT. Unfortunately, Hsieh (1970) does not provide us with detailed analyses of error types. This point thus calls for further experiments. I thank Eugene Buckley for bringing this issue to my attention.

argue that no Left/Initial Prominence is attested, which seems to be right, at least for the languages I have looked at so far.[7]

(iii) Tonal chain-shifts are by no means arbitrary and idiosyncratic. They are well-motivated, as have been extensively discussed in this paper.

(iv) Why do tonal chain-shifts seem to be "semi-productive" in experiment settings? Our analysis sheds light on this thorny issue, namely, because a tone sandhi form cannot be calculated without a comparison set of related words, which is not available for nonce words.

(v) In Zhang (2001), he proposed this ranking to accommodate the empirical data: *RISE (SHORT-SYLLABLE) » *FALL (SHORT-SYLLABLE) » *H (SHORT-SYLLABLE). If a simple tone (i.e. level tone) is absent in Environment X, then it implies that a complex tone (i.e. contour tone) does not occur, all other being equal. As has been extensively demonstrated above, this generalization is not always true. For instance, high tone is not allowed in non-prominent positions (i.e. phonetically short syllables) in Coastal Taiwanese; however, high rising tone and falling tone are both possible in sandhi contexts. Therefore, the distribution of contour tones may not be solely regulated by phonetic factors. As I have shown, avoidance of neutralization also plays an important role in this respect.

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[7]Tone sandhi in certain Hmong-mien (a.k.a. Miao-yao) languages seems to counter exemplify my claim. However, as far as I know, these are *Head-initial* languages and "Initial Prominence" is restricted to compound words. It might well be attributed to the effect of a top-ranked constraint requiring faithful realizations of tones on the head.

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