Neutralization of T3 and T5 Sandhi in Suzhou Chinese[*]

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This paper examines the two sandhi patterns of disyllabic compound whose initial tone is either a high falling tone (T3) or a dipping tone (T5) in Suzhou in the framework of Optimality Theory. The idea of different levels of tone melody in (Shih, 1986) is adopted in this paper. Namely, the syllable level tone melody changes to word level which lead to the neutralization of T3 and T5 sandhi. Left-headed metrical structure, foot formation and stress assignment are the main factors for the positional tone retention and deletion, while tone-syllable association and tonal sonority hierarchy help to evaluate the optimal output of the tone sandhi pattern ([HL.L] or [H.L]). The two sandhi patterns are argued to be outputs of different constraint ranking instead of syllable weight change.

1. Introduction

In Suzhou Chinese, when the citation tone on the initial syllable is either the high falling (T3, [HL]) or the dipping (T5, [HLM]) in a disyllabic word, the sandhi form of it can be either high level or high falling. The sandhi pattern of these disyllabic words is either [HL.L] (e.g. [tɕin^{HL}voŋ^{L}] "to believe") or [H.L] (e.g. [tɕin^{H}foŋ^{L}] "the envelope") in natural speech. For [HL.L], there is an alternating pattern whose second tone is a low rising tone ([HL.LM]) in deliberate speech. For [H.L], there is no perceptual difference in natural and deliberate speech. These phenomena are considered as tone sandhi neutralization of the two tones and analyzed in the framework of Optimality Theory in this paper.

The organization of the paper is as follows. In section 2, I generalize the sandhi patterns of disyllabic words whose initial tone is T3 or T5. In section 3, I review two issues referring to tone sandhi in Chinese dialects, pointing out the questions relating to these issues when it comes to the tone sandhi in Suzhou. In section 4, I provide my

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proposal and analysis, answering the questions raised in the previous section. Section 5 is the conclusion part.

2. Generalization on T3 and T5 Sandhi

There are five smooth tones and two entering tones in Suzhou. The tonal system mentioned in Li (1998) is summarized in (1).

(1) Tonal system in Suzhou Chinese

	high register		low register	
long	T1	H	T2	LM
	T3	HL		
	T5	HLM	T6	LML
short	T7	H	T8	LM

In this paper, due to the special property of the two entering tones, I discuss smooth tones only. The five smooth tones are divided into two groups in terms of register. There is a simple contour tone (/HL/ or /LM/) and a complex contour tone (/HLM/ or /LML/) in each register. The T3 and T5 sandhi discussed in this paper refers to the simple contour tone /HL/ and the complex contour tone /HLM/ in high register.

Based on the descriptive data in previous studies (Xie, 1982; Wang, 1983; Wang, 1996; Li, 1998), I draw generalizations on T3 and T5 in terms of speech tempo.

Speech tempo refers to the speech rate in which people speak the words out. In this paper, I regard the situation in which the first syllable is obviously longer than the second as natural speech, and the situation in which the durations of the two syllables are similarly long as deliberate speech. For the sandhi patterns containing a high falling tone on the first syllable, the former situation is represented as [HL.L], indicating a low tone follows a high falling tone. The latter situation is represented as [HL.LM], indicating a low rising tone follows a high falling tone. Since there is no perceptual difference between the pattern [H.L] in natural and deliberate speech, both situations are represented as [H.L]. Tone sandhi patterns of each type are summarized in (2) and (3).

(2) T3 and T5 sandhi compound I

1st morph.	2nd morph.	Combination		Gloss
[tɕiHL]	[tɛHH]	[tɕiHL tɛL]	[tɕiHL tɛLM]	'scissors'

[tsɻ^{HL}]   [dei^{LM}]   [tsɻ^{HL} dei^L]   [tsɻ^{HL} dei^{LM}]   'paper'

[tsɥ^{HL}]   [tʰɻ^{HL}]   [tsɥ^{HL} tʰɻ^L]   [tsɥ^{HL} tʰɻ^{LM}]   'main body'

[tsø^{HL}]   [tɕʰɻ^{HLM}]   [tsø^{HL} tɕʰɻ^L]   [tsø^{HL} tɕʰɻ^{LM}]   'go back'

[kɛ^{HL}]   [lɛ^{LML}]   [kɛ^{HL} lɛ^L]   [kɛ^{HL} lɛ^{LM}]   'olives'

[tɕjɛ^{HLM}]   [sɻ^{HH}]   [tɕjɛ^{HL} sɻ^L]   [tɕjɛ^{HL} sɻ^{LM}]   'teacher'

[jɻ^{HLM}]   [dəʊ^{LM}]   [jɻ^{HL} dəʊ^L]   [jɻ^{HL} dəʊ^{LM}]   'purpose'

[tsɻ^{HLM}]   [səʊ^{HL}]   [tsɻ^{HL} səʊ^L]   [tsɻ^{HL} səʊ^{LM}]   'toilet'

[pu^{HLM}]   [tsɻ^{HLM}]   [pu^{HL} tsɻ^L]   [pu^{HL} tsɻ^{LM}]   'arrange'

[tø^{HLM}]   [li^{LML}]   [tø^{HL} li^L]   [tø^{HL} li^{LM}]   'practice'

(3) T3 and T5 sandhi compound II

1st morph.	2nd morph.	Combination	Gloss
[kʰɔ^{HL}]	[tsʰu^{HH}]	[kʰɔ^H tsʰu^L]	'track'
[tɕʰɻ^{HL}]	[le^{LM}]	[tɕʰɻ^H le^L]	'to get up'
[tsø^{HL}]	[jɻ^{HL}]	[tsø^H jɻ^L]	'swivel chair'
[kʰɔ^{HL}]	[pʰi^{HLM}]	[kʰɔ^H pʰi^L]	'card'
[tsɛ^{HL}]	[vɛ^{LML}]	[tsɛ^H vɛ^L]	'breakfast'

[tɕɻ^{HLM}]   [tsʰu^{HH}]   [tɕɻ^H tsʰu^L]   'car'

[kwø^{HLM}]   [dei^{LM}]   [kwø^H dei^L]   'can'

[tʰəʊ^{HLM}]   [tsɻ^{HL}]   [tʰəʊ^H tsɻ^L]   'rabbit'

[səʊ^{HLM}]   [tsʰe^{HLM}]   [səʊ^H tsʰe^L]   'vegetable'

[jɔ^{HLM}]   [ɻ̩^{LML}]   [jɔ^H ɻ̩^L]   'night'

From (2) and (3), we can see there are two different patterns for T3 and T5 sandhi compound, which are summarized in (4).

(4) T3 and T5 sandhi in compound
a. When the original initial tone is a high falling tone, it will keep the same or become a high level tone after sandhi which are not free variations;
b. When the original initial tone is a dipping tone, it will become either a high falling tone, which is identical to the falling tone in the tonal system, or a high level tone after sandhi which are not free variations;
c. All the tones on the second syllable become a low tone after sandhi in natural speech;
d. In deliberate speech, tones on the second syllable become a low rising tone after a sandhi high falling tone;
e. [H.L] has no perceptual difference in natural and deliberate speech;
f. The tone shape of the disyllabic compound in natural speech is high falling.

(4c) and (4d) show that speech tempo can be used to explain why people cannot distinguish [HL.L] and [HL.LM] ([52.21] and [52.23] in previous descriptions). In this paper, I focus on the two patterns of compound in natural speech.

3. Problems
There are two sets of questions based on the analyses of tone sandhi in other Chinese dialects.

First, Yip (1995) mentioned that there are two types of tone sandhi. One is caused by pure tonal environment, like the third tone sandhi in Mandarin. The other type is caused by positional factors, in which tone on certain special position is preserved. A typical example of the second type is Shanghainese, in which the initial stressed tone retains and

re-associates to the syllables within the word. I accept that tone sandhi in Suzhou also belongs to the second type. Then the question is how to determine the position where tone is preserved. Moreover, what is the tone sandhi domain?
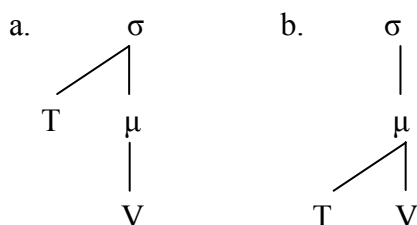
Second, Wright (1983), Chan (1991) and Wang (1996) propose a similar notion about the basic tones and tone sequence that occur in sandhi context in the dialect. I adopt the term "tone melody" in Shih (1986) and Chan (1991) here. Moreover, Shih (1986) mentions the tendency that tone melody is changing from syllable level to word level. If we adopt this word level tone melody, the tone shapes of the two patterns in natural speech are the same, from high to low. The question is whether they belong to one tone melody (/HL/)? If yes, how come this tone melody has two patterns ([HL.L] and [H.L])?

By answering these two sets of questions, I provide an analysis on the neutralization of T3 and T5 sandhi sandhi in Suzhou in the constraint-based approach.

4. Analysis

Before analyzing, the tone bearing unit (TBU) should be clarified first. Two possible structures in (5) show the relation between tone, segment, mora and syllable. Syllable types and tonal types provide evidence to support that (5a) is the right structure.

(5)

Unlike Northern Min in Jiang-King (1996), any type of syllable can occur with any kind of tone on one syllable in Suzhou, as shown in (6). Therefore, mora and syllable serve as different prosodic anchors. Data in (6) are provided by a native speaker.

(6) Syllable type and tonal type

	level	simple contour	complex contour
light	[sɿ^H]"silk"	[sɿ^{HL}]"dead"	[sɿ^{HLM}]"four"

heavy	[kəu^H] "brother"	[səu^{HL}]"count"	[səu^{HLM}]"vegetable"

Based on the two patterns in natural speech ([HL.L] and [H.L]) and their identical corresponding tone shape on disyllabic word, I propose this is related to the metrical structure in Suzhou and the disyllabic word is a prosodic word which forms the tone sandhi domain.

In section 4.1, the metrical structure of disyllabic word is proved to be left-headed first, followed by the definition of prosodic word. Then the investigation on tone melody related to T3 and T5 is shown. An OT account is provided in section 4.2, focusing on the two sandhi patterns which cannot be treated as free variations in natural speech.

4.1 Three related issues in Suzhou Chinese

First, the metrical structure is left-headed. Evidence from the different durations of the two syllables in disyllabic words supports that the initial syllable is stressed. Wright (1983) shows that stressed syllables have longer durations than unstressed syllables. I accept the relationship between syllable duration and stress, by measuring the recording from a native speaker of Suzhou Chinese. The average duration of each syllable in natural speech is listed in (7). "1stσ" indicates the citation tone on the first syllable and "shape" indicates the tone shape of the whole disyllabic word.

(7)

1stσ	shape	D1	D2	D1/D2	pattern	1stσ	shape	D1	D2	D1/D2	pattern
HL	H-L	180	78	2.31	HL.L	HLM	H-L	224	87	2.57	HL.L
	H-L	174	84	2.07	H.L		H-L	210	105	2.00	H.L

As pointed out in Zhu (2005), the absolute durations cannot reflect the stress difference, but the ratio of the durations can. If we assume that mora indicates syllable length, then the durational shows that the first syllable is bimoraic and the second syllable is monomoraic. In accordance with the Prominence Reduction constraint proposed in Jiang-King (1996), this phenomenon reflects that an unstressed syllable tends to be monomoraic.

Smith (2000) mentions that an initial or a stressed position is a prominent position which is more likely to retain its original properties, including the citation tone. Moreover, Wright (1983) also mentions that unstressed syllable tends to lose the original distinctive tone. Therefore, tone in the initial stressed position is preserved.

Second, the tone sandhi domain is a prosodic word which is defined in terms of stress. Selkirk and Shen (1990) regards that a prosodic word starts from the left edge of every lexical word. Duanmu (1993) uses loan words to argue that the tone sandhi domain is an association domain rather than a prosodic word in Selkirk and Shen (1990). He argues that an item which is not a lexical word can also form a tone sandhi domain. Therefore the prosodic word in Selkirk and Shen (1990) is not convincing enough. In Duanmu (1993), the association domain is defined purely by stress, which starts from a stressed syllable and ends before the next stressed syllable.

In this paper, I propose the tone sandhi in Suzhou is a prosodic word. The term "prosodic word" here belongs to the hierarchical categories in metrical theory, which consists at least one foot. The boundedness of the foot can be ignored here, because there are two syllables in a disyllabic word and they can form a binary foot which contains a stressed syllable and an unstressed syllable. That is to say, the tone sandhi domain here is a disyllabic prosodic word containing a stressed syllable and an unstressed syllable.

Third, there is only one word level tone melody for these two patterns, which is /HL/. Evidences come from the citation forms of T2 and T6 and their corresponding tone sandhi patterns. They are shown in (8), which is mentioned in Li (1998) and verified by a native speaker.

(8) Citation tones and their corresponding tone sandhi patterns

pattern	σ		σ σ	σ σ σ	σ σ σ σ
a.	44		44.21	44.44.21	44.44.33.21
b.	52	523	44.21	44.44.21	44.44.33.21
c.	52	523	52.21	52.22.21	52.22.22.21
d.	23	231	22.44	22.44.21	22.44.33.21
e.	23	231	23.21	23.33.21	23.33.22.21

The table indicates that there are two sets of sandhi patterns ((8d) and (8e)) for the low rising tone and rising-falling tone. This is similar to T3 and T5 sandhi patterns in (8b) and (8c). I propose there is a correspondent relation between citation tone, tone melody and sandhi patterns of disyllabic words, which can be summarized in (9) and generalized in (10).

(9) Correspondent relation between citation tone, tone melody and sandhi patterns

sandhi pattern	tone melody	citation tone

H.L	/H/	H	
H.L	/HL/	HL	HLM
HL.L			
L.M	/LM/	LM	LML
LM.L			

(10) Correspondent relation between citation tone, tone melody and sandhi patterns
a. There are three word level tone melody, /H/, /HL/ and /LM/. Level and simple contour tones correspond to the tone melody identical to themselves, while the complex contour tones correspond to the tone melody identical to their first two tonal elements;
b. /H/ has one corresponding tonal pattern which consists of a high tone and a low tone;
c. Both /HL/ and /LM/ have two corresponding tonal patterns, one consists of two level tones coming from the tone melody, and the other consists of a contour tone which is identical to the tone melody and a low tone;

(9a), (9c) and (9e) are grouped together as they all contain an inserted low tone, while (9b) and (9d) are grouped together as they consists of two level tones coming from the tone melody. From (8a) and (8b) we can see, Pattern b is completely neutralized to Pattern a.

The word level tone melody associates to the syllables within the prosodic word. Whether the TBU can bear contour tones determines the sandhi pattern. This is considered as the interaction between two constraints, one requires the stressed syllable must retain its input tone contour and the other requires single correspondent between TBU and tone.

Duanmu (1993) proposes a syllable weight distinction and argues that a light syllable cannot carry a contour tone while a heavy syllable can. He also argues that this distinction reflects a historical change from heavy syllable to light one and tone sandhi in Suzhou can reflect the intermediate stage of this change. But this historical change of syllable weight lacks evidence now. Comparing to the syllable weight change, level of tone melody change (Shih, 1986) is more possible and problems on different patterns can be solved by different tone-syllable association. Therefore, I attribute the occurrence of [HL.L] and [H.L] to the interaction between the two constraints rather than syllable weight change.

So far, the three issues answer the questions in section 3. Within a prosodic word, tone on the initial stressed position is retained (the dipping tone loses its rising tail) while tone on the non-initial unstressed position is deleted. The third issue shows the corresponding relationship between the preserved tone and the tone shape of the prosodic word, which is generalized in (4f). Moreover, it also shows there is only one tone melody

/HL/. This word level tone melody associates to each syllable and forms two tone sandhi patterns.

4.2 An OT account

In this part, a set of faithfulness constraints on tonal distributions is introduced first in (11). Word level tone melody is discussed and fixed in section 4.2.1, followed by tone-syllable association in section 4.2.2.

The Well-Formedness Conditions in Goldsmith (1967) are incorporated as a set of faithfulness constraints on tonal distributions (Jiang-King, 1996). They are listed as in (11) with a little change on TBU.

(11) Faithfulness constraints on tonal distributions
a. $P_{ARSE}T_{ONE}$: A tone must be incorporated into prosodic structure.
b. $S_{PEC}T_{ONE}$: A TBU must be filled by a tone.
c. $L_{INEARIRY}$: String$_1$ reflects the precedence structure of String$_2$, and vice versa.
d. $U_{NIFORMITY}$: No element of String$_2$ has multiple correspondents in String$_1$.
e. $L_{EX}T_{ONE}$: A tone that is present in an input must be present in an output.

(11a) and (11b) require every tone must be dominated by a TBU, and vice versa. (11c) reflects the condition that prohibits association lines crossing. (11d) requires one-to-one association between tones and TBUs, i.e. one level tone corresponds to one TBU. (11e) requires every tonal element in the input has a correspondent in the output.

4.2.1   Word level tone melody

The input of the positional tone sandhi is determined first, followed by the constraints responsible for foot formation and stress assignment in (14) and those for positional tone retention and deletion in (16).

The word level tone melody will be determined according to the tone in the stressed position which is restricted to complex contour tone. $*C_{OMPLEX}C_{ONTOUR}/I_{NITIAL}\sigma$ indicates this restriction. The candidate competition can be shown in (13).

(12) $*C_{OMPLEX}C_{ONTOUR}/I_{NITIAL}\sigma$: A complex contour tone cannot occur on the initial syllable in a multisyllabic word.

(13) Initial complex contour tone restriction

Input σ σ H L M T	$P_{ARSE}T_{ONE}$	$S_{PEC}T_{ONE}$	$L_{INEARIRY}$	$*C_{OMPLEX}C_{ONTOUR}/I_{NITIAL}\sigma$	$L_{EX}T_{ONE}$

a.　　σ　　σ 　　H　L　M T				*!	
b.　　　σ　　σ ☞H　L　　T					*

From the tableau we can see that the dipping tone [HLM] is simplified as [HL] in the initial position and there is no change on the second tone. "T" stands for any smooth tone on the second syllable.

In accordance with Li (1998), the current tone sandhi pattern originates from purl tonal combination, where two tones keep their citation forms in disyllabic word. Only tonal simplification takes place at this stage as in (13) and it may due to articulatory reason and speech rate. (13b) works as the input of the positional tone sandhi later.

After determining the input of the positional tone sandhi, a set of constraints are responsible for the left-headed metrical structure. (14a) is satisfied by parsing every syllable by foot. (14b) requires the alignment of a foot and a prosodic word. (14c) requires the stressed position to be on the left edge of a foot.

(14) Stress assignment constraints

a.　　　　$P_{ARSE}S_{YL}$: Syllables are parsed by feet.

b.　　　　$A_{LL}F_TL$: The left edge of a foot must be aligned with the left edge of a prosodic word.

c.　　　　T_{ROCHEE}: The head of a foot must be aligned with the left edge of the foot.

The tableau in (15) shows the optimal foot structure within a prosodic word. (15b) and (15d) are first ruled out by violating $P_{ARSE}S_{YL}$. (15c) is ruled out due to the position of the head, which is not initial and violating T_{ROCHEE}. Without violating any of these constraints, (15a) is the optimal output.

(15) Foot formation and stress assignment

Input $[σ□σ]_{P_RW_D}$	$P_{ARSE}S_{YL}$	$A_{LL}F_TL$	T_{ROCHEE}
☞　a. $[(σ□σ)]_{P_RW_D}$			
b. $[σ□σ]_{P_RW_D}$	*!*		
c. $[(σσ□)]_{P_RW_D}$			*!
d. $[σ(σ□)]_{P_RW_D}$	*!	*	

Finally, the word level tone melody will be determined according to the preserved tone in the stressed position which is restricted to complex contour tone. Constraints in (16) determine the positional tone retention and deletion (Li, 2003).

(16) Positional tone retention and deletion

a. $M_{AX}(T_{ONE})/\sigma\Box$: T must have a correspondence in the output if T is a tone on the stressed syllable in the input.

b. $*T_{ONE}$: Any TBU with a tone in the output is banned.

In Suzhou, the initial stressed syllable retains its input tone while the non-initial unstressed syllable loses its citation tone. This phenomenon can be captured by ranking $M_{AX}(T_{ONE})/\sigma\Box$ over $*T_{ONE}$, as show in the following tableau. $M_{AX}(T_{ONE})/\sigma\Box$ does not concern on the association between TBU and tones, therefore, both (17c) and (17d) satisfy $M_{AX}(T_{ONE})/\sigma\Box$. $*T_{ONE}$ makes (17d) to be the optimal output, which indicates that a syllable level tone becomes a word level tone melody.

(17) Positional tone retention and deletion

Input σ□ σ T₁ T₂ T₃ T₄	$M_{AX}(T_{ONE})/\sigma\Box$	$*T_{ONE}$
σ□ σ T₁ T₂ T₃ T₄		**!
σ□ σ T₃ T₄	*!	*
σ□ σ T₁ T₂		*!
☞ σ□ σ T₁ T₂		

Till now, the word level tone melody is determined by ranking the constraints responsible for stress assignment and positional tone preservation and deletion. The ranking must be as follows.

(18) $P_{ARSE}S_{YL} \gg A_{LL}F_{T}L \gg T_{ROCHEE}$

$\gg$

$M_{AX}(T_{ONE})/\sigma\Box \gg *T_{ONE}$

4.2.2 Tonal assignment

Due to $P_{ARSE}T_{ONE}$ and $S_{PEC}T_{ONE}$, tones must be associated to syllables. The tone-syllable association and optimal tone sandhi pattern evaluation will be discussed one by one.

First, the ranking of $U_{NIFORMITY}$ determines the allowance of contour tone (Jiang-King, 1996). Assuming a contour tone consists of two level tones (Odden, 1995), $U_{NIFORMITY}$ prohibits the stressed syllable to bear a contour tone, while $I_{DENT}(T_{ONE})/\sigma\square$ requires the stressed syllable to retain its input tonal specification (Li, 2003). This constraints competition is illustrate in (20).

(19) $I_{DENT}(T_{ONE})/\sigma\square$: A tonal specification on a stressed syllable in the input must have a correspondence with an identical specification in the output.

(20) Constraint ranking determines the allowance of contour tone

Input $\sigma\square$ σ T_1 T_2	$M_{AX}(T_{ONE})/\sigma\square$	$U_{NIFORMITY}$	$I_{DENT}(T_{ONE})/\sigma\square$	Remarks
a. $\sigma\square$ σ T_1 T_2	√	√	*	Level tone allowed
b. $\sigma\square$ σ T_1 T_2	√	*	√	Contour tone allowed

From (20) we can see that both (20a) and (20b) satisfy $M_{AX}(T_{ONE})/\sigma\square$, since both of them retain the tone on the stressed syllable in the input. When $I_{DENT}(T_{ONE})/\sigma\square$ is ranked over $U_{NIFORMITY}$, then contour tone can be retained on the stressed syllable. When $U_{NIFORMITY}$ is ranked over $I_{DENT}(T_{ONE})/\sigma\square$, only level tone is allowed on the stressed syllable. Therefore, the two sandhi patterns of the high falling tone or the dipping tone can be captured by the interaction of these two constraints.
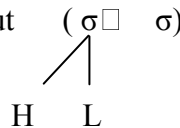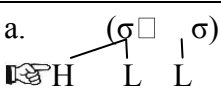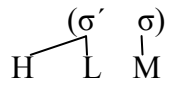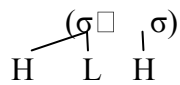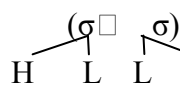
Second, tonal sonority hierarchy proposed in Jiang-King (1996) and de Lacy (2002) determines the optimal output of the sandhi pattern. This tonal sonority hierarchy plays an essential role when there is a position without a specified tone (20b) and a low tone is the optimal tone to be assigned to the vacant position.

(21) Tonal sonority hierarchy
$*N_{ON}H_D/H \gg *N_{ON}H_D/M \gg *N_{ON}H_D/L$: A low tone is the most unmarked tone on the unstressed syllable.

A violation marked is assigned when there is a low tone on the unstressed syllable. If there is a mid tone on this syllable, then two violation marks are assigned. Similarly, assign three violation marks if there is a high tone. Therefore, a low tone is better than a mid tone (22b) or a high tone (22c), and a simple level tone is better than a contour tone (22d).

(22) Tonal preference on the unstressed syllable

Input (σ□ σ) H L	*N$_{ON}$H$_D$/H>> *N$_{ON}$H$_D$/M>> *N$_{ON}$H$_D$/L
a. (σ□ σ) ☞H L L	*
b. (σ´ σ) H L M	**!
c. (σ□ σ) H L H	**!*
d. (σ□ σ) H L L M	**!*

From (20) and (22), we can also find out that *T$_{ONE}$ can be ignored. On the one hand, candidate that satisfies *T$_{ONE}$ must be ruled out due to the two high ranked constraints, P$_{ARSE}$T$_{ONE}$ and S$_{PEC}$T$_{ONE}$. On the other hand, tone on the second syllable is fixed due to the constraints interaction in (20) and (22). If the output satisfies M$_{AX}$(T$_{ONE}$)/σ□ and U$_{NIFORMITY}$, the first and second syllable both bear a level tone. If the out put satisfies M$_{AX}$(T$_{ONE}$)/σ□ and I$_{DENT}$(T$_{ONE}$)/σ□, the tonal sonority hierarchy works and tone on the second syllable is assigned with a low tone.

By ignoring *T$_{ONE}$, there are two set of constraint ranking according to the sandhi pattern. The ranking for each optimal output is summarized in (23) and (24).

(23) [HL.L] as the optimal output

M$_{AX}$(T$_{ONE}$)/σ□

>>

I$_{DENT}$(T$_{ONE}$)/σ□ >> U$_{NIFORMITY}$

>>

$*N_{ON}H_D/H \gg *N_{ON}H_D/M \gg *N_{ON}H_D/L$

(24) [H.L] as the optimal output

$M_{AX}(T_{ONE})/\sigma\square$

$\gg$

$U_{NIFORMITY} \gg I_{DENT}(T_{ONE})/\sigma\square$

$\gg$

$*N_{ON}H_D/H \gg *N_{ON}H_D/M \gg *N_{ON}H_D/L$

5. Conclusion

The neutralization of T3 and T5 sandhi in Suzhou Chinese shows the positional tone sandhi which is significantly related to the tone in stressed position. I propose there is only one word level tone melody (/HL/) for the disyllabic words whose initial tone is high falling or dipping.

$*C_{OMPLEX}C_{ONTOUR}/I_{NITIAL}\sigma$ is an essential constraints that provide the input of the positional sandhi. Constraints $P_{ARSE}S_{YL}$, $A_{LL}F_TL$ and T_{ROCHEE} determine the left-headed metrical structure in Suzhou, while $M_{AX}(T_{ONE})/\sigma\square$ and $*T_{ONE}$ determine the positional tone retention and deletion. The retained syllable level tone on the stressed syllable behaves as the word level tone in the remaining tone sandhi process.

The interaction between $U_{NIFORMITY}$ and $I_{DENT}(T_{ONE})/\sigma\square$ determines the allowance of contour tone on the stressed syllable. Contour tone is allowed when $I_{DENT}(T_{ONE})/\sigma\square$ is over ranked $U_{NIFORMITY}$. $*N_{ON}H_D/H \gg *N_{ON}H_D/M \gg *N_{ON}H_D/L$ requires a low tone to be associated to unstressed syllable. When $U_{NIFORMITY}$ is ranked over $I_{DENT}(T_{ONE})/\sigma\square$, only level tone is allowed. The first syllable is assigned with the first part of the tone melody, and the second syllable is assigned with the second part of the tone melody. I assume this constraint competition causes the two possible sandhi patterns of the prosodic words initial with a high falling tone or a dipping tone, instead of the historical syllable weight change.

A deep investigation of the tone melody needs to be taken in further study, as well as an exploration of the patterns in deliberate speech.

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