2014

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Casual Speech Elision and Tone Sandhi in Tianjin Trisyllabic Sequences♠

Abstract

In the Tianjin dialect, casual utterance of familiar trisyllabic sequences often induces deletion of phonological segments so that for a trisyllabic string, the non-final syllables would merge into a single syllable. This elide-and-merge process interacts with the rich Tianjin tone sandhi system to produce rather complicated patterns.

In this paper, casual speech elision is shown to falls out straightforwardly from a model that recognizes morae as associated with segments and also as tone-bearing units. Thus, elision of morae also removes tonal features. While this understanding provides a clear description of the patterns, it also reveals an ordering paradox: sandhi applies before elision in some cases, but after elision in others. The paradox is resolved by favoring the order that produces a contour tone for the merged syllable. An explanation for this can be found if one recognizes that Tianjin is prosodically iambic.

Keywords:

Casual Speech, Elision, Tone sandhi, Mora, Prosody, Tianjin

1. *Introduction*

Casual and allegro speech is often garbled, characterized by truncation or elision to the “original” word string of more careful or normal utterances. English provides us with many familiar examples like *wanna* and *gotta* from “want to” and “got to” respectively. In these cases, the /t/ (two of them in fact) is elided followed by the spreading of /n/ to form the onset of the following syllable in the case of *wanna* (for more data, see Labov 1969; Selkirk 1972; Pullum 1997, and references therein). For languages like English, the patterns of elision are confined to the segments/phones involved, but for tonal languages the situation is further complicated by the presence of lexical tone. This paper explores one such tonal language, the Tianjin dialect of the Northern Mandarin genus, where Casual Speech Elision (henceforth CSE) is common and highly productive, and where there is a complex system of tonal alternation. Some data exemplifying the object of this study is presented in (1), using capitalized letters to denote the tonal contour on each syllable.

(1) Tianjin Casual Speech Elision

a. /ɕauR ɕiL kuanL/ "little west fort"
→ [ɕɔiR kuanL][1]

b. /tɕʰiF ɕaŋF tʰaiH/ "weather station"
→ [tɕʰiaŋL tʰaiH]

c. /tienF ʂʅF tɕiL/ "television set"
→ [tieʅR tɕiL]

As may be seen in (1), a number of things seem to be happening all at once. Firstly, there is the loss of segments which is the character of casual speech elision. In the cases shown here, trisyllabic strings are reduced to disyllabic ones presumably following the loss of consonants intervening between the initial and medial syllables of the input strings. Secondly, there is the alternation of tones from the input string to the output string. Thirdly, there is also the change of segmental quality so that we see [ɔ] in the output of (1a) where there was no such phone in the input string. These three observations may be reduced to the interaction of two main sub-patterns: (i) the elision of segmental material and the merging of residue to form a new syllable and (ii) how tone sandhi applies to unelided or elided strings.

As will become clear in section 2, CSE is most easily understood using a moraic model of the syllable, so that when morae are removed, segmental material follows. Remaining morae merge to form a new syllable. The moraic model is also useful in explaining the tone patterns that accompany CSE, since removal of morae likewise disposes of any associated tonal feature. To facilitate understanding of the tonal patterns, section 3 outlines the basics of Tianjin tone sandhi. With the rudiments of CSE and tone sandhi in place, section 4 moves on to study how these two process interact, and it is revealed that in some cases sandhi-operations must apply before elision and merging, but in other cases the order of application is reversed. This ordering paradox finds a solution in the requirement that the merged syllable prefers to bear a contour tone, a situation that has implications on Tianjin prosody. Though the interaction between CSE and tone sandhi is intricate and potentially confusing, it really only boils down to the three points listed in (2) below.

(2) a. Morae are elided during casual speech;

b. Tone features are associated to morae;

c. Application of tone sandhi and casual speech elision is ordered in such a way as to produce a contour tone for the merged syllable.

2. *Tianjin Casual Speech Elision*

2.1 *Basic Patterns of CSE*

Tianjin CSE was first reported in a dialectological study in Wee, Yan, & Lu (2005) where they presented data involving trisyllabic strings, the minimal length needed before CSE could apply. Li (2006) has subsequently made further investigations in Tianjin on this matter, and some variations have been reported, presumably due to a different set of informants.[2] Similar dialectological studies have been made in at least three other Chinese languages, notably Zhang (2000) on place names in Beijing Mandarin, Hsu (2003a, 2004) on Taiwanese Southern Min, and Ong (2006, 2007) on Malaysian Cantonese. Presumably, CSE in longer string can be reduced to combinations involving trisyllabic substrings. For convenience, (3) provides a schematic representation of trisyllabic strings.

(3) Schematic representation of trisyllabic strings

Initial σ (syllable) Medial σ Final σ

Window I Window II

A number of different CSE patterns are identified in Wee, Yan, & Lu (2005), summarized here in (4).

(4) a. CSE at Window I

i.	mien faŋ tʂ^{h}aŋ	→ miaŋ tʂ^{h}aŋ	"cotton factory"
ii.	pau kuŋ t^{h}ou	→ pɔŋ t^{h}ou	"foreman"
iii.	tɕi kuan tɕ^{h}iaŋ	→ tɕyan tɕ^{h}iaŋ	"machine gun"
iv.	tuŋ fɑŋ xuŋ	→ tɔŋ xuŋ	"The east is red"
v.	ɕiŋ xua ts^{h}uən	→ ɕyã ts^{h}uən	"gingko blossom village"
vi.	tɕ^{h}i ɕaŋ t^{h}ai	→ tɕ^{h}iaŋ t^{h}ai	"weather station"

b. Elision of the medial syllable

i. mau tsɤ tuŋ → mau tuŋ name of Chairman Mao

ii. p^{h}ai tʂ^{h}u suo → p^{h}ai suo “police station”

iii. tɕ^{h}yen ie tʂ^{h}aŋ → tɕ^{h}yen tʂ^{h}aŋ name of mall

c. Other kinds of CSE

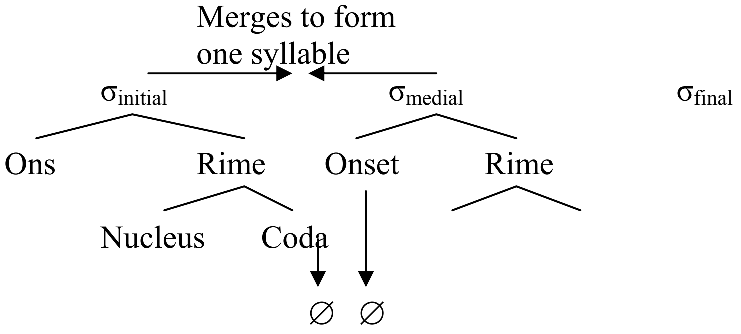
i. ʐən min pi → ʐəm pi Renminbi

ii. kuo min taŋ → kuom taŋ Kuomingtang

iii. t^{h}ai p^{h}iŋ tɕie → t^{h}aim tɕie Peace Street

The pattern in (4a) is by far the most robust and is attested in a large number of cases. This pattern will be the main concerns of this paper. In (4a), phonological material, in particular the consonants, at Window I is elided. Once the intervening consonants are removed, the initial and medial syllables merge to form a new syllable, schematically shown in (5).

(5) CSE by merging of initial and medial syllables (see (4a))



The (4b) kind involves the deletion of the entire medial syllable; (4c) presents cases that seem to be instances of gestural overlap involving nasals and labiality. Examples belonging to (4b) are generally not very productive, and are probably lexicalized to some extent. Only the pattern in (4a) is truly generative in the sense that one can easily find such examples or create new input strings from which a speaker of the Tianjin dialect can then produce the CSE form. In fact, Wee, Yan, & Lu (2005) characterize that in Tianjin CSE (i) all coda elements of the initial syllable will be elided, including vowel glides /i/ and /u/; (ii) onsets of the medial syllable would be elided if they are any of [k, k^h, x, ts, ts^h, s, tʂ, $tʂ^h$, ʂ, ʐ, tɕ, $tɕ^h$, ɕ, f]; and (iii) following the removal of intervening consonants, residue material merge, with vowel coalescence in some cases (e.g., (4aii) where /a/ and /u/ coalesce to form [ɔ]), to form a new syllable. For the rest of this paper, all references to CSE are to the (4a) type only.

This set of onset segments that could undergo CSE, all of which are [-sonorant] and with the exception of /f/ also [-labial], is expanded when the initial and medial consonants alliterate, so the full list would include all onset segments.

(6) /l/ as an onset with CSE

a.	pa liŋ $tɕ^h$i	→ pa liŋ $tɕ^h$i	“8-0-7”
b.	xuaŋ liaŋ ɕi	→ xuaŋ liaŋ ɕi	“Huang Liangxi” (a name)
c.	li liaŋ i	→ liaŋ i	“Li Liangyi” (a name)

In (6), the medial syllable has /l/ for an onset, which does not undergo CSE (6a, b) unless it is alliterative with the initial syllable as in (6c).

It is also noteworthy that CSE of the (4a) type is most likely to produce complex patterns with respect to tone sandhi (more in section 4).

2.2 *Syllable Structure of Tianjin*

The generalization of Tianjin CSE as given in (5) is expressed in terms of the Onset-Rime model of the syllable (but see (10) below for moraic representation). Regardless of one's theoretical position on how best to represent the syllable, the data presented thus far shows that the Tianjin syllable size is constrained so that when the initial and medial syllables merge to form a new syllable under CSE, vowels sometimes coalesce, e.g., (4aii) pau kuŋ t^hou → pɔŋ t^hou "foreman".

The largest syllable observed in the Tianjin data presented thus far is a C-G-V-G/N string where the final segment can either be a glide /i, u/ or one of the nasals [m, n, ŋ]. In addition to this observation, I would like to add that the minimal prosodic word in Tianjin is a fully-toned monosyllable (e.g., *xuŋ* "red", *fei* "fly", *mien* "cotton" etc). Since minimal words are necessarily binary feet at either the mora or syllable level, it is reasonable to assume that the typical Tianjin syllable must be a bimoraic foot (McCarthy & Prince 1995:320-321, and numerous references cited therein). This leaves open the possibility of the medial glide as being non-moraic (and interpreted as part of the onset in the onset-rime model), or moraic (interpreted as part of the rime in the onset-rime model).

(7) BIN[μ]

Every syllable must be bimoraic.

BIN [μ], sometimes written as FT-BIN (Kager 1999:156 among others), buys us some desirable outcomes in relation to Tianjin. Firstly, it predicts that Tianjin would have monosyllables that are non-words by virtue of being mono-moraic. This is indeed so as there are "light" syllables in Tianjin (generally bearing neutral tone) which are often bound morphemes (for such examples, see Wang 2002). Secondly, recall the vowel coalescence in Tianjin CSE, which is now capturable as having multiple vocalic root nodes associated to a singular mora (more later in section 2.3). Thirdly, if each fully-toned word were indeed bimoraic, the four Tianjin tones L, H, R, F are easily expressible as tonal features that associate with each mora, with the further prediction that deletion of morae would result in deletion of tonal features. This, as we shall see in section 3 and section 4, is rather convenient in understanding CSE patterns.

In any case, the C-G-V-G/N restriction on the size of the Tianjin syllable may be captured within a moraic model with the help of *SPLIT-μ. This constraint ensures that a mora may not be associated with more than one segment, thus restricting moraic items to the V-G/N substring, and relegating the medial G to a non-moraic position.[3]

(8) *SPLIT-μ

Each mora may only be associated to one segmental root node.

Relegating the medial glide to non-moraic status is certainly not a novel idea, and has in fact been argued for in Bao (1990), Wang (1999), Duanmu (1990, 2000, 2002), Ma (2003) and Sun (2006).[4]

2.3 *Deriving the CSE pattern with OT*

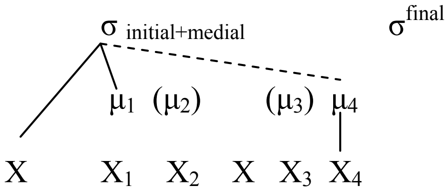
With an understanding of the Tianjin syllable, it is now easier to apprehend the patterns of CSE, the most relevant ones repeated here as (9).

(9) CSE at Window I (from (4a)

i.	mien faŋ tʂʰaŋ → miaŋ tʂʰaŋ		"cotton factory"
ii.	pau kuŋ tʰou → pɔŋ tʰou		"foreman"
iii.	tɕi kuan tɕʰiaŋ → tɕyan tɕʰiaŋ		"machine gun"
iv.	tuŋ faŋ xuŋ → tɔŋ xuŋ		"The east is red"
v.	ɕiŋ xua tsʰuən → ɕyã tsʰuən		"gingko blossom village"

As noted before, CSE removes the segments of the coda of the initial syllable and the onset of the medial syllable, then merging the remaining material to form a new one. This may be described in a moraic model diagrammatically in (10), where two morae and their corresponding segments are deleted, together with the non-moraic segment (i.e., the onset) of the medial syllable.

(10) Mapping after CSE at Window I



, where X are the segmental root nodes.

Evidently, (10) is inadequate in that it does not capture any of the vowel coalescence and something needs to be said about how $X_{1\text{-}3}$ can be mapped to the remaining morae.

However, it is a good start in capturing the basic insight of what material is elided and also the merger of syllables. Vowel coalescence would have to be attributed to remapping the segmental nodes associated with the elided morae. We can see from (9) that the competition would be for μ_1 with X_1, X_2 and X_3 as potential competitors vying for association. Inherited from the original unelided form are the associations between the initial X as the "onset" of the initial syllable and between X_4 and μ_4 as the "coda" of the medial syllable.

Returning to the competition between X_1, X_2, and X_3 for μ_1, the driving force must be attributed to a faithfulness constraint such as MAX.

(11) MAX

Do not delete input segmental root nodes.

If X_1 is [i] or [u], MAX need not be violated since [i,u] make good medial glides that can be treated as non-moraic and may hang off directly from the syllable node. This seems to be the case with (9i), where [mien] merges with [faŋ] to produce [miaŋ] following the deletion of [n] and [f]. If *SPLIT-μ has not been violated in [miaŋ], then it must be because [i] is non-moraic. Even with X_1 out of the competition, there is still X_2 and X_3 vying for μ_1. Examples like (9ii) pau kuŋ tʰou → pɔŋ tʰou "foreman" suggests that vowel coalescence occurs where possible so that [a]+[u] produces [ɔ] (akin to Schane 1984; Archangeli & Pulleyblank 1994, and similarly in Hsu 2003b). This is a possible violation of *SPLIT-μ if we assume that this is a situation where a single mora is associated with two vocalic melodies. MAX would not be violated with respect to [a] and [u] since these are both preserved but merely mapped to the same mora. A derivation of (9ii) can be done assuming the ad hoc constraints in (12).

(12) TRUNC(ATE) (see also Kager 1999:265)

Merge into a single syllable.[5]

PT-σ

Tianjin syllables must obey phonotactic requirements.

The constraints in (12) are rather ad hoc. TRUNC is really a simplistic version of other general constraints that conspire to create an iamb-footed disyllabic word out of a trisyllabic string in Tianjin. [6] PT-σ is really shorthand for bunch of constraints that would derive the phonotactic requirements with the Tianjin syllable. The role of PT-σ here is to dictate that when syllables merge, ill-formed syllables do not surface.[7] I shall not pursue the details here for fear of confusing detours, but instead simply state the crucial properties of such phonotactics in (13).

(13) Some Tianjin phonotactics

a. Given VVX in a rime, the second must be more sonorant.

b. For a rime, uVN, N cannot be velar nasal.

With these constraints (9i, ii, iv) can be derived as (14).

(14) a. Deriving (9i)

Input: CSE + mien faŋ tʂ^{h}aŋ “cotton factory”	TRUNC	PT-σ	MAX	*SPLIT-μ
i. mien faŋ tʂ^{h}aŋ	*!			
ii. mi[$_{\mu\mu}$eaŋ] t^{h}ʂaŋ			**	*!
iii. ☞ mi[$_{\mu\mu}$aŋ] t^{h}ʂaŋ			**	

b. Deriving (9ii)

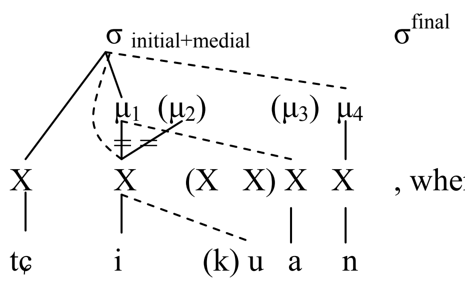
Input: CSE + /pau kuŋ t^{h}ou/ “foreman”	TRUNC	PT-σ	MAX	*SPLIT-μ
i. pau kuŋ t^{h}ou	*!			
ii. pa[$_{\mu\mu}$uŋ] t^{h}ou		*!	**	
iii. ☞pɔŋ t^{h}ou			**	*

c. Deriving (9iv)

Input: CSE + tuŋ faŋ xuŋ “The east is red”	TRUNC	PT-σ	MAX	*SPLIT-μ
i. tuŋ faŋ xuŋ	*!			
ii. tu [$_{\mu\mu}$aŋ] xuŋ		*!	**	
iii. ☞ tɔŋ xuŋ			**	*

Moving on to (9iii) and (9v), we have the cases where [y] is presumably formed from the coalescence of [i] and [u]. In (9iii), [tɕi] and [kuan] merge to become [tɕyan], diagrammatically shown in (15).

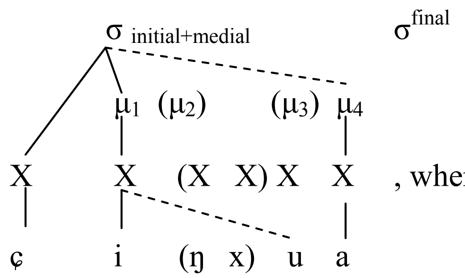
(15) Deriving (9iii)



, where X is a segmental root node

Since both [i] and [u] are high vowels, they qualify as glides and can be preserved under the influence of MAX by associating directly with the syllable, thus freeing-up μ_1 for the preservation of [a]. This satisfies TRUNC with minimal violations to MAX and *SPLIT-μ. The same story may be told of (9v), shown in (16) below.

(16) Deriving (9v)



, where X is a segmental root node

Essentially, the competition for moraic association after elision pushes [high] vowels to become non-moraic glides in order to preserve as many of the original segments as possible.

Now, there are two complications to the story of CSE in Tianjin. Firstly, as noted earlier, medial onsets which are [+sonorant] are faithfully preserved under CSE, though secondly, even these are deleted when there is alliteration (see (6), repeated here as (17)).

(17) /l/ as an onset with CSE

a.	pa liŋ tɕʰi	→ pa liŋ tɕʰi	"8-0-7"
b.	xuaŋ liaŋ ɕi	→ xuaŋ liaŋ ɕi	"Huang Liangxi" (a name)
c.	li liaŋ i	→ liaŋ i	"Li Liangyi" (a name)

The failure of CSE to apply in the cases where the medial onsets are [+sonorant] can be dispensed with by ranking FAITH [son, cons] above TRUNC. FAITH [son, cons] however, it would be overridden by *ALLIT.

(18) *ALLIT

Do not allow adjacent syllables to have identical onsets.

FAITH [son, cons]

Do not delete [+sonorant, +consonant] segments.

Admittedly, *ALLIT appears ad hoc, though it can be more easily appreciated as a convenient package of OCP-related constraints at the consonantal-tier (in non-linear phonological frameworks such as autosegmental phonology Goldsmith (1976) and with special references to consonants and vowels in McCarthy's (1979) account on Semitic languages). Alliteration involves identity of consonants. In the case of Tianjin trisyllabic CSE, it would mean adjacency of identical elements at the consonantal plane. By whatever route, what one has to capture would be that elision applies over otherwise protected sonorant consonants when there is alliteration.

2.4 *Interim summary*

This section has explained that the Tianjin CSE is driven by TRUNC to reduce a trisyllabic string into a disyllabic one. The reduction of syllables removes morae, consequently threatening the segments that hang off them. MAX comes to the rescue by either pushing [high] vowels to become glides or by coalescence so that the vocalic melodies now share a mora, at the cost of *SPLIT-μ. Crucial in this account therefore is the construal of the Tianjin syllable as bimoraic, which is also useful in capturing the tone sandhi patterns that accompany CSE.

3. *Detour: Tianjin Tone*

If we recall the examples in (1), repeated below as (19), we shall see that the CSE patterns have rather intricate tonal alternations.

(19) Tianjin Casual Speech Elision

a. /ɕauR ɕiL kuanL/ "little west fort"

→ [ɕɔiR kuanL]

b. /tɕʰiF ɕaŋF tʰaiH/ "weather station"

→ [tɕʰiaŋL tʰaiH]

c. /tienF ʂʅF tɕiL/ "television set"

→ [tieʅR tɕiL]

In the examples above, it is not entirely easy to see how, for instance a rising tone R would come out of the combination of two F tones in (19c) / tienF ʂʅF tɕiL / → [tieʅR tɕiL] "television set". At the very least, a detour into the tones and sandhi of Tianjin would be necessary. Thus, nothing in this section is new, for the main objective here is to familiarize the reader with the character of Tianjin tone sandhi as accounted for in preceding works, notably Li & Liu (1985), Yip (1989), Chen (2000), Wee (2004), and Zhang & Liu (2011).

Tianjin has an inventory of four basic tones: Low, High, Rising and Falling, such that ditonal combinations produce 6 sandhi patterns. Thus out of 16 (= 4^2) possible ditonal combinations, only 10 ditonal outputs are attested (Wee 2004 and Wee, Yan, & Chen 2005:7).

(20) Ditonal Sandhi in Tianjin

a. LL → RL e.g., [fei.tɕi] "air plane"

b. RR → HR e.g., [mai.mi] "buy rice"

c. FF → LF e.g., [pau.kau] "report"

d. RH → LH e.g., [tʂu.rən] "master/owner"

e. RF → LF e.g., [xau.ta] "very big"

f. FL → HL e.g., [tʂʰaŋ.kɤ] "sing a song"

Early discussions of Tianjin ditonal sandhi have been confined to (20a,b,c,f), all based on field-reports by Li & Liu (1985), later supported by Ma & Jia (2006). However, Zhang & Liu's (2011) finely-executed phonetic study vindicates the position that there are six ditonal sandhi patterns.[8]

In any case, Yip (1989) observes that Tianjin ditonal sandhi may be understood as instances of OCP, where in (20a-c) the constraint applies to the entire tone contours F, R, and L and in (20d-f) the constraint applies at the level of tone features that comprises the contour, i.e., [high][low] for F so that FL would have a string of tone features [high][low].[low].

Putting aside the non-sandhi of /HH/ inputs for the moment, the constraints active in Tianjin for triggering sandhi in (20a-c) would be as listed in (21).

(21) OCP [T]

Do not allow adjacent tone T.

IDENT-HD

Head syllable must have an identical correspondence between input and output.

IDENT[T]

Input tonal contour must have an identical correspondence in the output.

HD-RT

For any branching node N, the element from the rightmost branch is the head.

OCP[T] is a generalized OCP constraint on tones where T is variable, referring to any of the four tone contours L, H, R, and F. IDENT[T] forbids unmotivated input~output mismatches, except where triggered by OCP[T].[9] When that happens, IDENT[T]-HD and HD-RT[10] would target the alternation at the initial syllable, demonstrated in (22).

(22) Deriving Tianjin Ditonal Sandhi

/LL/	OCP [T]	IDENT-HD	IDENT[T]	HD-RT
i. LL	*!			
ii. ☞XL			*	
iii. LX		*!	*	
/HH/				
i. ☞HH				
ii. XH			*!	
iii. HX		*!	*	

In (22), I have used X to indicate the tone that has undergone sandhi, and have used /LL/ as a representative of /RR/ and /FF/ sequences. The choice of X would become clearer only when one takes a composite view of tone contours: contours are made up of sequences of tone features such as [low] and [high] (Yip 1980, 1995; Bao 1990; Duanmu 1990; with roots in the autosegmental representation of tone in Leben 1973; Williams 1976, and Goldsmith 1976). Thus, R and F are respectively (23a, b).

(23) Compositionality of contour tones

a. F: high low

b. R: low high

Simplex contours like L and H would have only one feature, so that a tonal template would be something like (24).

(24) Structural representation of tone

Tone Contour: tone feature tone feature

or

Tone Contour: tone feature

An account for F→L; L→R and R→H in (20a-c) is then simply the effect of MAX[t] and DEP[t] under the influence of OCP[T]. F→L and R→H by the loss of the first tone feature, [low] and [high] respectively for the two cases above, violate MAX[t]. L→R is accounted for by the insertion of a [high] tone feature, violating DEP[t].[11] These constraints are presented in (25) (see also Yip 2002 for discussions on such general constraints on tones).

(25) MAX[t]

Do not delete tone features

DEP[t]

Do not insert tone features

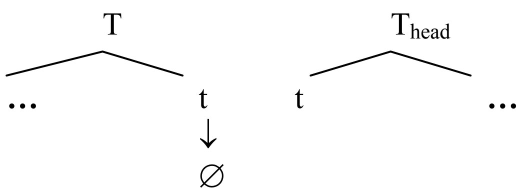
Chen (2000, following Yip 1989) explains FL→HL is the result of OCP applying at the level of the tone feature, which would extend naturally to R→L/ __{H,F} in (20d,e). The relevant OCP constraint would be as given in (26).

(26) OCP[t][12]

Do not allow adjacent identical tone features

To get F→H and R→L for (20d-f), all one needs to do is remove the offending element, which is the second tone feature of each composite tone. Thus, F becomes H when the [l] element is removed and similarly for R when the [h] element is removed.

(27) Resolving OCP[t] violations



To be precise, the OCP account as given presently is incomplete for it leaves behind a list of questions like why HH doesn't undergo sandhi having violated OCP[h] which would otherwise trigger RH→LH and RF→LF. Similarly, what about FR which violates (26) but is allowed to stay unsandhied while FL→HL? Alternative accounts have certainly been proposed, and among them Hyman (2007) suggests that

Tianjin sandhi is triggered by the Principle of Ups and Downs (PUD) which militates against contours so that when RR→HR, FF→LF or RF→LF, the number of peaks and troughs in pitch decreases. Evidently, something more will need to be said about LL→RL which actually increases the number of contours, and why RF does not sandi to become HF instead which would be even more leveled in pitch than LF. I believe that the OCP account is the right one and a coherent account is possible, as in fact has been provided in Wee (2013).

In any case, for the purposes of understanding Tianjin CSE, the crucial matter is the compositionality of tone contour from simple tone features and the basic understanding of the set of sandhi patterns as listed in (20). Whether one buys into the OCP account, the PUD account or other accounts is immaterial; the reader is free to substitute whatever is believed to be the correct trigger for sandhi when trying to understand the interaction between CSE and tone (section 4). As will be seen next, the OCP account also provides a more cogent story for tritonal patterns, since as noted in Chen (2000), it is the avoidance of OCP that guides the directionality effects of sandhi-application.[13]

Sandhi patterns of longer strings are derivable from the rudimentary rules in (20) and require little elaboration except for two remarks. Firstly as noted in Chen (2000), OCP[T] offences must be resolved before OCP[t], exemplified below in (28).

(28) OCP resolved before OCP’

a. /FFL/ → [LHL]

i. tʂan ʂaŋ fəŋ “gain the upperhand”

ii. tʂau ɕaŋ tɕi “camera”

iii. sɹ sɹ san “4-4-3”

Derivation:
<u>FF</u>L
| by FF→ LF (see OCP[T])
L<u>FL</u>
| by FL → HL (see OCP [t])
LHL

b. /FLL/ → [FRL]

i. suŋ ɕen xua “give fresh flowers”

ii. wai tɕau kuan “diplomat”

iii. sɹ san san “4-3-3”

Derivation:
F<u>LL</u>
| by LL → RL (see OCP[T])
FRL FL not applicable, no further sandhi applies

In (28a,b), underlining indicates the site of tone sandhi with vertical shafts connecting tones to their sandhied outcome below. In order to obtained the attested results, OCP[T] must be resolved first. In (28b), the resolution of OCP[T] bleeds OCP[t] type sandhi.

Secondly when resolving OCP[T] offences, tone sandhi applies from left to right unless such an order of sandhi application produces derived OCP[T] violations in the process. This property becomes clear when one considers the cases of /LLL/ and /RRR/ simultaneously.

(29) Directionality in tone sandhi

a. /RRR/ → [HHR]

i. tʂɻ̩ y san "paper umbrella"

ii. tʂan lan kuan "exhibition hall"

iii. tɕiou wu tɕiou "9-5-9"

Derivation:
<u>RR</u>R
| by RR → HR (see OCP[T])
H<u>RR</u>
| by RR → HR
HHR

b. /LLL/ → [LRL]

i. k^hai fei tɕi "fly an air plane"

ii. kuŋ tsɹ kau "high salary"

iii. san pa san "3-8-3"

Derivation:
L<u>LL</u>
| by LL → RL (see OCP[T])
LRL

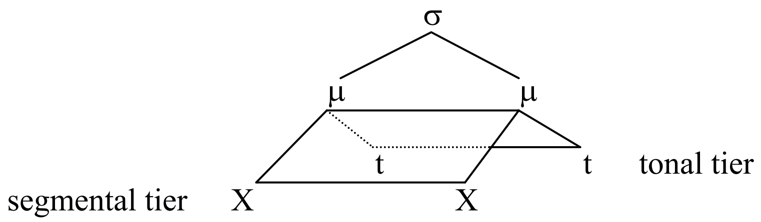
As may be seen in (29a), the derivation of /RRR/ → [HHR] requires the rule to apply in counterbleeding order, creating what McCarthy (1998, 2003) would call non-surface apparent opacity since the RR→ HR rule has applied more than necessary to resolve all OCP[T] offending collocations. In this case, the order is from left to right.

However, the reverse is true for (29b), where LL→ RL has applied in the bleeding order, removing both OCP[T] offending collocations in one alternation. The reason, according to Chen (2000), is that a left-to-right order for /LLL/ would create RRL as an intermediary, with an OCP[T] offending collocation interim. This preemptive clause that OCP[T] resolution cannot create interim OCP[T] offending sequences would account for the difference in directionality between (29a) and (29b).

The points made in (28) and (29) do not lend themselves easily to a classical OT approach by nature of their derivational character. This does not concern us here, but an attempt at how OT can account for these patterns is available in Wee (2004). For the purpose of understanding Tianjin CSE, it would suffice for us to note the basic patterns of tone sandhi and the assumption that contour tones are composed of simple tone features.

The idea of simple tone features comprising Tianjin contour tones also find resonances in the treatment of Tianjin neutral tones. Wang (2002) writes that the full Tianjin syllable contains two morae, each of which is a tone-bearing unit.[14] In his treatment, neutral tone syllables are either inherently short thus having only one mora, or is the result of reduction of a full syllable by one mora. Thus, neutral tone syllables in Tianjin are characterized as either H or L, never R or F and are always short. These syllables are also necessarily bound. Following Wang's lead, therefore, a Tianjin syllable would have the representation in (30), where a syllable would be bimoraic such that the morae would associate on the one hand to segmental root nodes and on the other to tonal features.[15]

(30) Segment and tone association to moraic tier



4. *Elision and Tone Sandhi*

With the basic understanding of CSE and tone sandhi in place, it is now possible to explicate on the intricate challenges underlying the elision-sandhi interaction. The thrust of the examples in (1) (repeated as (19)) is that a coherent way of understanding the patterns would lead to a paradox, the climax of this paper.

4.1 *A dilemma in order*

Let us begin with a close study of (19b, c), and it would reveal a certain order in the elision-sandhi interaction.

(31) Casual Speech Elision with tone sandhi

a. /tɕ^{h}iF ɕaŋF t^{h}aiH/ "weather station" (see (1b) or (19b))

→ [tɕ^{h}iaŋL t^{h}aiH]

b. /tienF ʂʅF tɕiL/ "television set" (see (1c) or (19c))

→ [tieʅR tɕiL]

	input	(31a) /tɕʰi ɕaŋ tʰai/ |\ | | | | μμ μμ μμ | | | | |/ h l hl h	(31b) / tien ʂʅ tɕi/ | | / | |\ μμ μμ μμ | | | | |/ hl hl l
Step 1	tone sandhi (FFH→LFH; FFL→LHL)	tɕʰi ɕaŋ | \ | | μ μ μμ | / | | l h l	tien ʂʅ | | / \ μ μ μ μ |/ \ / l h
Step 2	elision	tɕʰi (ɕ)aŋ | \ | | μ (μ) (μ)μ | | | l (h) l	tie(n) (ʂ) ʅ | | / \ μ(μ) (μ) μ | | l h
Step 3	merging of syllables	tɕʰiaŋ | | μ μ | | l l	tieʅ | | μ μ | | l h
	output	[tɕʰiaŋL tʰaiH]	[tieʅR tɕiL]

The order of application in (31) is important, because any change in the order will yield incorrect outputs for one or the other. For example, if elision applied before sandhi, (31a) will produce an output *FH tone sequence and (31b) will produce *HL (possibly via FL), both contrary to fact.

However, for cases like (19a), repeated here as (32a), it appears that elision must be ordered before tone sandhi.

(32) Tianjin Casual Speech Elision with tone sandhi

a. /ɕauR ɕiL kuanL/ "little west fort" (see (1a) or (19a))

→ [ɕɔiR kuanL]

b. /tɕeR faŋF tɕynL/ “People’s Liberation Army”

→ [tɕaŋR tɕynL]

<table>
<tr><td></td><td>input</td><td>/ ɕau ɕi kuan/
|| |\ ||
μμ μμ μμ
|| V V
lh l l</td><td>/ tɕe faŋ tɕyn/
/\ || ||
μμ μμ μμ
|| || V
lh hl l</td></tr>
<tr><td>Step 1</td><td>elision</td><td>ɕ au (ɕ) i
V |
μ(μ) (μ)μ
| |
l (h) l</td><td>tɕe (f) a ŋ
| | |
μ (μ) (μ)μ
| |
l (h) (h) l</td></tr>
<tr><td>Step 2</td><td>merging of syllables</td><td>ɕ ɔ i
| |
μμ
| |
l l</td><td>tɕ a ŋ
| |
μ μ
| |
l l</td></tr>
<tr><td>Step 3</td><td>tone sandhi (LL→RL)</td><td>ɕ ɔ i
| |
μμ
| |
l h</td><td>tɕ a ŋ
| |
μ μ
| |
l h</td></tr>
<tr><td></td><td>output</td><td>[ɕɔiR kuanL]</td><td>[tɕaŋR tɕynL]</td></tr>
</table>

In the case of (32a), had tone sandhi applied first, the tonal output would have been *HL (RLL→RRL→HRL, see section 3) rather than RL; similarly with (32b).

We now have an ordering paradox: cases in (31) require that sandhi apply after CSE and (32) the reverse. Of 64 possible tritonal outputs, only 23 make different predictions depending on the order between CSE and sandhi. Of these 13 require sandhi to apply before CSE, five require the reverse and five are uncertain because these instances are not found in Wee, Yan, & Lu’s (2005) corpus. These are sorted in (33). An * indicates unattested outputs and the cells are greyed out. All examples are taken from Wee, Yan, & Lu’s (2005) corpus.

(33) Elision-sandhi order depending on tritonal input

tritonal input	**sandhi then elision (see (31))**	**elision then sandhi (see (32))**	**Example**
HLF	FF	*LF (via FF)	tʂ^{h}aŋH tɕaŋL tauF → tʂ^{h}aŋF tauF “Yangtse river course”
HFF	FF (via HLF)	*LF (via FF)	fəŋH tʂʅF tɕiŋF → fərF tɕiŋF “a name”
RRF	FF (via HLF)	*LF (via RF)	maR tʂaŋR tauF → maŋF tauF “street name”
FLF	FF (via HLF)	*LF (via FF)	tienF təŋL p^{h}auF → tieŋF p^{h}auF “light bulb”
FFF	FF (via HLF)	*LF (via FF)	taF tsɿF pauF → taɿF pauF “poster”
LHF	RF	*LF (via RF)	tʂuŋL wənH ɕiF → tʂuənR ɕiF “Chinese department”
FFL	RL (via LHL)	*HL (via FL)	tienF ʂʅF tɕiL → tieʅR tɕiL “television set”
RHH	RH (via LHH)	*LH (via RH)	tuŋR wənH xuaH → tuənR xuaH “a name”
LHR	RR (via LHR)	*HR (via RR)	tɕaL xaiH iouR → tɕaeR iouR “more at home”
RHR	LHR→RR	*RR→HR	xauR lienH tɕouR → xɔenR tɕouR “a name”
RHF	RF (via LHF)	*LF (via RF)	liR ɕiŋH tɕienF → liŋR tɕienF “a name”
FRH	FH (via HLH)	*HH	ʂaŋF kuR linH → ʂauF linH “ancient forest”
FFH	LH (via LFH)	*FH	tɕ^{h}iF ɕaŋF t^{h}aiH → tɕ^{h}iaŋL t^{h}aiH “weather station”
RLL	*HL (via (HRL)	RL (via LL)	liR ʂuaŋL tɕaŋL → lyaŋR tɕaŋL “a name”
RRL	*HL (via HRL)	RL	liR kuR iL → liuR iL “a name”
FFR	*LR (via LFR)	FR	tʂauF iauF liR → tʂɔF liR “street name”
LHH	*RH	LH (via RH)	tʂaŋL xuŋH miŋH → tʂɔŋL miŋH “a name”
RRH	*FH (via HLH)	LH (via RH)	liR iaR ruŋH → liaL ruŋH “a name”
LHR	RR	HR (via RR)	Not available
LRR	RR (via LHR)	HR (via RR)	Not available
LRF	RF (via LHF)	LF (via RF)	Not available
HRH	FH (via HLH)	HH	Not available
HRF	FF (via HLF)	HF	Not available

Apart from /LHH/ and /RRH/ (both undergo CSE to produce LH), it seems that the order of sandhi and CSE is regulated by having disyllabic outputs that begin with a contour tone.[16] Since merged syllables contain material from two sources, it is conceivable that contour tones are preferred as a way to indicate its inherited complexity. This would account for all cases except /LHH/ and /RRH/, both of which undergo CSE to surface as LH. It is hard to say exactly what is happening with these two cases, but I suspect that the Tianjin L, which is very low, is physiologically much more straining that it would be on a par with contour tones in terms of articulatory effort (see Ohaha1978 for example on how the larynx is relevant for pitch control, and Laver 1980:29). I will have no more to say about these two cases for now.

4.2 *Iambic feet*

With the exception of /LHH/, /RRH/, /FHF/ cases, what is common about all remaining the CSE outputs is the preference for a contour tone for the merged syllable (i.e., $\sigma_{\text{initial+medial}}$). At the very least, we can now say that the ordering of CSE and tone sandhi is resolved by favoring the output that produces a contoured tone for the merged syllable.

Viewed in terms of tonal features, all CSE outputs have the form [tt.t] (e.g., {FFL, RLL, RRL}→RL; RHH→RH; FRH→FH) or [tt.tt] (e.g., {HLF, HFF, RRF, FLF, FFF}→FF; {LHF, RHF}→RF; {LHR,RHR}→RR; FFR→FR). This preference for a more complex tone in the merged syllable producing [tt.t] or [tt.tt] outputs is reminiscent of prosodic feet. Wee, Yan, & Lu (2005) provide the following measurements.

(34) Duration of normal and CSE utterances

	Average total length	Average length of σ_{final}	Average length of $\sigma_{\text{initial+medial}}$	Length % of non-final syllable
Normal	0.6173s	0.2557s	0.3615s	58.56%
CSE	0.4623s	0.2444s	0.2179s	47.13%

For the normal articulations without CSE, the lengths of the three syllables are unremarkable. The first two syllables take up nearly 60% of the total length and the final syllable is only slightly longer, which is typical. With CSE, however, the lengths of the material of the non-final syllables have indeed shorted to take up nearly half the total length of time, suggesting that the trisyllabic sequence has indeed truncated into two syllables. This is what we expect given the account that σ_{initial} and σ_{medial} merge to become a single syllable $\sigma_{\text{initial+medial}}$.

These measurements suggest that the CSE produces essentially two feet out of a trisyllabic string, each foot a single syllable. In other words, the tonal outputs of CSE are parsed into [($_{\text{foot}}$ tt) ($_{\text{foot}}$ t)] or [($_{\text{foot}}$ tt) ($_{\text{foot}}$ tt)], where t stands for a tonal feature. Firstly, this is because each fully-toned syllable is a prosodic word in Tianjin. Secondly, analyzing two contour tones as a single foot ($_{\text{foot}}$ tt tt) leads to problems in characterizing that as iambic or trochaic. If ($_{\text{foot}}$ tt tt) were iambic, then ($_{\text{foot}}$ tt.t) would be a bad iamb and we would be forced to say that Tianjin CSE produces incoherent metric structures. If ($_{\text{foot}}$ tt tt) were trochaic, it would be a good trochee only if the merged syllable is more prominent (i.e., carrying stress or accent), but we have no evidence of that. Given that the final syllable after CSE is still slightly longer than the merged syllable, we cannot appeal to length for independent justification. Perhaps there are ways to provide a trochaic analysis for the CSE tonal outputs, but it seems easiest to adopt an iambic analysis that the disyllabic output of CSE is two feet, each containing one syllable. In order to fulfill length requirements of an iambic foot, the merged syllable must be a contoured tone. The final syllable is exempt from this requirement because (i) the tones of final syllables are exempt from tone sandhi in the first place; and (ii) CSE operations do not target the final syllable so that in all cases, tone of the final syllable is the same regardless how sandhi and CSE is ordered.

4.3 *Opacity*

As may be seen in (31), the sandhi-then-CSE account produces sandhi-triggering sequences such as FF, RR, RH, and RF. This naturally spells trouble for non-derivational frameworks such as classical parallel OT where the same constraints that trigger sandhi would apply with equal force to the outputs of CSE. There are a number of possible approaches to this issue, all of which I think are viable and am therefore unable to choose at this point.

The first possibility is to treat CSE as something that happens on a phonetic level while sandhi is something that applies at the phonological level. This approach implies that phonological operations apply before phonetic ones. My main reservation about such an approach is that it would be difficult to deal with cases where CSE applies before tone sandhi. A second possibility is to appeal to McCarthy's (2002) comparative markedness, so that the sandhi-triggering environments derived from CSE operations are treated as less marked than sandhi-environments that are not derived by CSE. Naturally, faithfulness requirements would have to dominate the derived sandhi-triggering forms. Again, my main reservation lies in the difficulty in dealing with cases where CSE applies before sandhi. This difficulty will also apply if one opts for a stratal OT approach (Kiparsky 2009), a transderivational faithfulness approach (Benua 1997) or any approach where the two orders of CSE-sandhi application cannot be flipped around by comparing the outcomes.

Yet, in all these cases, the problem might be resolved by positing a high-ranked constraint on the foot requirement that CSE outputs prefer a tonally complex merged syllable.

5. *Conclusion*

This paper begins with a description of Casual Speech Elision (CSE) that results in the merging of non-final syllables into a single syllable for a given trisyllabic string. Such a process inevitably impacts on the already complex tone sandhi patterns of Tianjin. It turns out that CSE removes morae that also happen to be tone-bearing units. The CSE-sandhi interaction can be described through a combination of the tone sandhi rules and the elision process, and it was found that whether sandhi applies before CSE or after depends on the output. In general, the chosen order is the one that produces a contour tone for the merged syllable.

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NOTES

♠ This work is supported by the FRG/07-08/II-09, FRG2/11-12/135 and GRF250712. I am indebted to K.P. Mohanan, Bruce Morén, Li Mingxing, Yan Xiuhong, and the anonymous reviewers for their very helpful comments. Thanks also to Hongming Zhang for encouraging me with this paper so that it now gets to meet the world. This work takes as its point of departure the data and some generalizations given in Wee (2005) and Wee & Yan (2006), but tackles an ordering paradox in the elision-sandhi interaction not addressed in these works.

[1] It is unclear if [ɕɔi] should really be [ɕiɔi] but it doesn't really matter in this paper.

Medial glides that are homorganic with the onset may really just be an acoustic by-product of the alveolopalatal consonants in such examples anyway. For example, Ladefoged and Wu (1984) omit the glide in their transcriptions of Beijing Mandarin, which has similar issues with Tianjin in this respect. Non-homorganic glides such as [miɛn] 'cotton' would of course require different treatment.

[2] As far as I can tell, the variation does not have any major impact on this present study, but it is noteworthy that the set of informants used in the Wee, Yan, & Lu (2005) study belonged to an older generation who are arguably less influenced by the very dominant Beijing speech.

[3] Naturally, one would expect also something like *SPLIT-X that would forbid the multiple association of a segmental root node to different morae. This constraint would be lowly ranked in Tianjin since open syllables such as *ta* "big" are also common.

[4] Using either an onset-rime model or a moraic model, these authors, except Sun (2006), believe that the medial glide is part of the "onset" either as a cluster or as a

singular segment involving secondary articulation. Sun (2006) suggests that the medial glide hangs off as a ternary branch directly from the syllable and hence neither part of onset nor rime.

[5] This effect is also possible by appealing to HD-RT and IDENT-HD, assuming Tianjin to be right-headed. The combined effect of these constraints would be to produce two iambic feet by reducing three syllables to two heavy ones.

[6] Though I have explained earlier that the syllable is a minimal prosodic word in Tianjin, there is no contradiction in requiring an iambic foot out of a disyllabic word, as may be see in Hyman's (2003) noteworthy distinction between minimal word and metrical word. In earlier literature such as Shih (1986), this would be distinguished in terms of feet and superfeet.

[7] The careful reader might wonder if there are truncation possibilities that remove edge segments such as the onset of the initial syllable or the coda of the medial syllable. A constraint such as MAX-EDGE would address the problem, though this may not even be necessary given other general requirements like sonority peak of various phonotactic restrictions in Tianjin.

[8] However, based on normalized F0 contours, Zhang & Liu (2011) query the validity of using L, H, R F as accurate descriptors and if sandhi is truly neutralizing. Rather than dwelling with the intricacies, this paper shall accept (20a-f) as they are since they allow clear expression of the phonological patterns.

[9] One way to make OCP[T] inactive to HH is to recognize that OCP[T] is a family of constrains with OCP[L], OCP[R], OCP[F] and OCP[H] all potentially ranked separately. Thus ranking OCP[L]; OCP[R]; OCP[F] » FAITH » OCP[H] would do the

trick. However, we shall see later that OCP[t], prevention of HH from sandhi is in fact a much trickier issue.

[10] One could in principle collapse HD-RT and IDENT[T]-HD into IDENT[T]-RT. However, it has been shown in Nelson (1998, 2003) that positing positional faithfulness constraints that make direct reference to the element of the right branch would have pathological typological consequences. As such all prima facie right-faithfulness must be the combination of headship and faithfulness to head positions.

[11] Similarly for (20d-f), the second tone feature is deleted for R and F to produce R→L and F→H respectively.

[12] OCP applying at different levels is not peculiar to tones, such patterns are also found in treatments on geminates and adjacent homorganic segments. Diagrammatically, a contour tone as represented in (21) has two levels, and phonological processes can apply to both.

[13] A PUD account would have to work out how /FFL/ does not yield LFL given that /LLL/→LRL, among other cases. The OCP account in comparison captures the patterns with two simple notions: (i) OCP[T] before OCP[t] and (ii) rightward application of sandhi unless output violates OCP.

[14] See also Morén & Zsiga (2006) for a similar discussion in Thai that contour tones are the result of different tone features associated to different morae of a syllable. Thai level tones are singly linked to the final mora so that L or H begins somewhere in the mid-tone then falls or rises respectively. One wonders if Tianjin might be similar since tone values of L and H of Tianjin are given as [21] and [45] respectively in Li & Liu (1985) in agreement with the pitch tracks in Shi (1990). This, however, is tangential to the CSE patterns at hand.

[15] The TBU has been argued to be the syllable (Odden 1990; Clements 1984; Yip 1995) or the mora (Clements 1986, Pulleyblank 1994; Duanmu 1990, 1994). As evidence for both positions grows, it is unsurprising that Yip (2002) suggests that the TBU differs across languages. The crucial thing is that the TBU is a prosodic unit.

[16] Treatment using sandhi-then-CSE as default order is defeated by the impossibility of providing a trigger for /LHH/ inputs to disfavor [RH] outputs under CSE. After all, [RH] CSE outputs are acceptable for /RHH/ inputs.