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Violable phonotactics in syllable contraction: A corpus-based study

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This paper establishes four corpora of syllable contraction, including a Taiwanese corpus, a Hakka corpus, and two Mandarin corpora. Several patterns are found based on these corpora. First, the high-ranked vocalic markedness constraints in Taiwanese and Hakka are often violated in syllable contraction; the vowels of the source syllables are retained and combined in the contracta to preserve the original meaning of the source syllables. Second, labial codas that are banned in Mandarin often occur from syllable contraction. Finally, in the Mandarin X-not-X contraction, the negator [pu] is often neutral-toned such that the [u] vowel is truncated but the faithfulness of [p] tends to dominate the markedness constraints.

0. Introduction

Syllable contraction has attracted much attention in the last three decades. Chung (1996, 1997) adopts Yip's (1988) edge-in association to account for the derivation of full contraction. In the Taiwanese form [kain], contracted from [ka in] 'with them', the edge-in association first links [k] and [n] to the onset and the coda respectively. The medial vocalic melodies are then linked from left to right such that [a] is linked to the nucleus before [i]. However, the derived output contains four slots, in violation of the Taiwanese phonotactics. The edge-in association then fails to predicts the form [bua kin], contracted from [bo iau kin] 'doesn't matter'; it would first link [b] and [u] as the onset and the coda, but would not allows the truncation of [u]. Hsu (2003) suggests that the vocalic melody association is subject to sonority. She modifies Kiparsky's (1979) sonority hierarchy "a > e > o > i > u" with the addition of [ɔ] between [a] and [e]. In this sense, [a] is the most sonorous and thus is linked to the nucleus first, and then [o] is raised as [u], whereby [bua] is derived in (1). Li and Myers (2005) report that in addition to [bua], two other forms, [biau] and [buau], are possible variants. They demote the ranking of the phonotactic constraint, since forms like [buau] clearly violate the phonotactics of Taiwanese. Similar violations of Taiwanese phonotactics are found in several other works, such as C. Tseng (1999), Hsiao (2002), Hsu (2005), among others. This paper thus intends to investigate further the role of phonotactics in syllable contraction. I will address the following questions. What types of phonotactic constraints can be violated in syllable contraction? What phonotactic constraints are undominated? Are violations of certain types of phonotactic constraints common among these dialects? How do universal constraints interact with phonotactic constraints? In this paper, I focus on vocalic combinations and codas. I will offer an analysis under the framework of Optimality Theory (Prince and Smolensky 1993/2004), in particular the Stochastic OT. The rest of this paper is organized as follows. Section 1 introduces the corpora. Section 2 discusses illegal vocalic combinations in Taiwanese contraction. Section 3 addresses illegal vocalic combinations in Hakka contraction. Section 4 examines illegal codas in Mandarin contraction. Section 5 reinvestigates the X-not-X contraction in Mandarin, followed by a summary in section 6.

1. The Corpora

This research establishes four contraction corpora. First, the corpus of Taiwanese contraction is based on 20 hour's conversation by 2 males and 2 females. They are native speakers of Taiwanese, aged from 66-72. This corpus collects 1124 contracta. Second, the corpus of Sixian Hakka contraction is based on 20 hour's conversation by 2 males and 2 females. They are native speakers of Sixian Hakka, aged from 58-63. This corpus collects 870 contracta. Third, the corpus of Mandarin contraction is based on 10 hour's conversation by 2 males and 2 females. They are native speakers of Mandarin, aged from 20-22. This corpus collects 1788 contracta. Finally, the corpus of Mandarin X-not-X contraction is based on 4 hour's citation of a phrase list by 4 males and 4 females. They are native speakers of Mandarin, aged from 20-24. This corpus collects 160 contracta. In these four corpura, segments, tones, and syllable structures are coded.

2. Illegal vocalic combinations in Taiwanese contraction

In Taiwanese, non-low vowels that have the same [back] feature may not be adjacent, such as *ei, *ie, *ou and *uo, where the asterisks indicate the four constraints. Table (1) shows the relevant statistics of the Taiwanese corpus.

(1) Vocalic combinations in Taiwanese contraction

S	C	T	%	E	G
a. e + i	ei	99	98.1%	se53 zi33 ⟶ sei53	'to be careful'
	e	2	1.9%	kue53 k^hi53 hia55 ⟶ kue53 hia55	'to go there'
	Total	101	100.0%		
b. i + e	ie	87	91.6%	si53 ke53 tsau53 ⟶ sie53 tsau53	'to go everywhere'
	e	8	8.4%	tsit5 e55 ⟶ tse55	'this'
	Total	95	100.0%		
c. o + u	ou	112	100.0%	to21 kun53 ⟶ toun35	'earthworm'
	o	0	0.0%		
	Total	112	100.0%		
d. u + o	uo	102	100.0%	tu55 ho53 ⟶ tuo53	'exactly'
	o	0	0.0%		

Total	102	100.0%

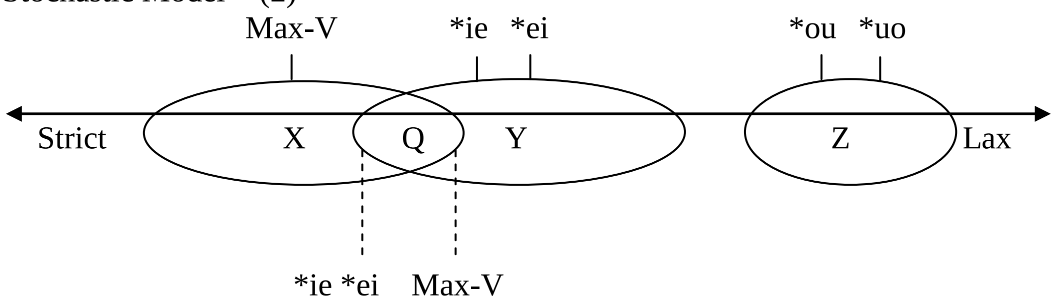
S stands for sources, C for contracta, T for tokens, E for examples, and G for glosses. As in (1a), there are 101 contracta that are combined from [e] and [i]; 99 of them form the [ei] dipthong, found in 98.1%, while only 2 of them are truncated as the [e] vowel, found in 1.9%. In (1b), there are 95 contracta that are combined from [i] and [e]; 87 of them form the [ie] sequence, found in 91.6%, while only 8 of them are truncated as the [e] vowel, found in 8.4%. In (1c), there are 112 contracta that are combined from [o] and [u]; all of them form the [ou] diphthong, found in 100%. In (1d), there are 102 contracta that are combined from [u] and [o]; again, all of them form the [uo] sequence, found in 100%.

A constraint ranking can be observed in (2), where Max-V dominates *ei and *ie, while *ou and *uo are ranked at the bottom.

(2) Constraint ranking: Max-V >> *ei, *ie >> *ou, *uo

In terms of Stochastic OT (Boersma 2000, Hayes 2000, and Boersma & Hayes 2001), each constraint is assigned a selected point on the ranking scale, as in (3).

(3) Stochastic Model = (2)



The selected point is not a single point, but is associated with a range of values, as shown by the ovals. The center of the range is called the ranking value. If the ranges of the selected points do not overlap, the ranking is categorical. In this case, Max-V is always ranked higher than *ou and *uo; as in (1c) and (1d), no [u] truncation is found. On the other hand, if the ranges overlap, the ranking is variable. In (3), Q indicates the overlapped area, where Max-V may choose a part that is lower than *ie and *ei, as shown by the dashed lines. Accordingly, the vocalic markedness constraints outrank Max-V; as in (1a) and (1b), there are a few cases of [i] truncation, where Max-V is violated.

The four vocalic markedness constraints are not usually violated. In regular Taiwanese syllables, diphthongs like [ie], [ei], [uo] and [ou] are completely absent. Hsiao (2011) also observes that when a Taiwanese speaker pronounces Mandarin words with those diphthongs, monophthongization occurs in his accent, as shown in (4).

(4) Monophthongization in Taiwanese-Mandarin (Hsiao 2011)

Taiwanese-Mandarin	Mandarin	Taiwanese	Gloss
p^he	p^hei	pue	‘to accompany’
tse	tɕie	tɕioʔ	‘to borrow’
ko	kuo	kok	‘nation’
t^ho	t^hou	t^hau	‘to steal’

The four vocalic markedness constraints usually outrank faithfulness constraints such as Max-V, a constraint ranking that forces the truncation of the high vowel. However, Max-V dominates the vocalic markedness constraints in syllable contraction, as shown in (2). A possible reason for the high ranking of Max-V can be to retain the meaning. Precisely, vowel is the most sonorant or prominent element in a syllable, and the survival of the source vowels preserves the semantic content of the source syllables in the contraction.

3. Illegal vocalic combinations in Sixian Hakka contraction

Sixian Hakka also has the four vocalic markedness constraints: *ei, *ou, *uo and *ie. Table (5) shows the relevant statistics in the Sixian Hakka corpus.

(5) Vocalic combinations in Sixian Hakka contraction

S	C	T	%	E	G
a. e + i	ei	58	100%	ke ki (sɔŋ pai) ⟶ kei (sɔŋ pai)	‘that he/she (last time)’
	e	0	0%		
	Total	58	100%		
b. i + e	ie	167	74.9%	ki11 teu24 ⟶ kie11	‘they’
	e	0	0%		
	ia	56	25.1%	ki11 ke55 ⟶ kia24	‘his’
	Total	223	100%		
c. u + oi	uoi	9	41%	tu55 oi55 ⟶ tuoi55	‘to want all’
	oi	3	13.6%	tu55 oi55 ⟶ toi55	
	ui	2	9%	tu55 oi55 ⟶ tui55	
	ua	8	36.4%	iu55 oi55 ⟶ iua55	‘to also want’
	Total	22	100%		

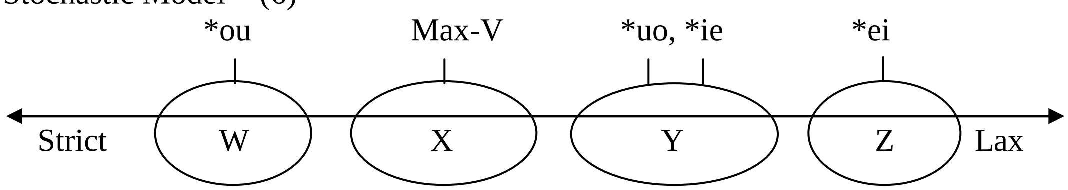
In (5a), there are 58 contracta that are combined from [e] and [i]; all of them form the [ei] dipthong, found in 100%. In (5b), there are 223 contracta that are combined from [i] and [e]; 167 of them form the [ie] sequence, found in 74.9%, while 56 of them are lowered as the [ia] sequence, found in 25.1%. In (5c), there are 22 contracta that are combined from [u] and [oi]; 9 of them form the [uoi] sequence, found in 41%, 3 are truncated as [oi], found in 13.6%, 2 are truncated as [ui], found in 9%, and 9 are lowered as [ua], found in 36.4%. In this corpus, I find no contracted [ou] that is combined from [o] and [u].

A constraint ranking can thus be observed in (6), where *ou dominates Max-V, which in turns dominates *uo and *ie, while *ei is ranked at the bottom.

(6) Constraint ranking: *ou >> Max-V >> *uo, *ie >> *ei

The scale in (7) shows that the constraint ranking is categorical, since no ranges of the selected points overlap.

(7) Stochastic Model = (6)



In (5b), there is a relatively larger amount of [ie] contracta. The reason is as follows. In spite of the fact that the [ie] diphthong is usually avoided in Sixian Hakka, this language allows the surface sequences, [ien] and [iet], which are respectively derived from [ian] and [iat] (Chung 2004). The [i] and [e] vowels of the source syllables are either combined as [ie] or lowered as [ia] in the contracta. Again, the high percentage of vowel preservation serves to preserve the meaning of the source syllables.

4. Illegal codas in Mandarin contraction

Mandarin allows no stop coda, nor a bilabial nasal coda. Five markedness constraints are active in conditioning the coda: namely, *-m, *-p, *-t, *-k and *-ʔ. In syllable contraction, *-m and *-p can be violated, while the other three constraints are strictly observed. Table (8) shows the relevant statistics in the Mandarin corpus.

(8) Codas in Mandarin contraction

S	C	T	%	E	G
a. V + k	Vk	0	0%		
	V	355	100%	tʂɤ53 kə22 ⟶ tʂɤ52	‘this’
	Total	355	100%		
b. V + t	Vt	0	0%		
	V	208	100%	tʂʰɨ55 toŋ55 ɕi55 ⟶ tʂʰoŋ55 ɕi55	‘eat (sth)’
	Total	208	100%		
c. V + ʔ	Vʔ	0	0%		
	V	134	100%	uo21 ʔa55 ⟶ ua25	‘It’s me.’
	Total	134	100%		

d. V + m	Vm	126	100%	uo21 mən35 ⟶ uom25	‘we’
	V	0	0%		
	Total	126	100%		
e. V + p	Vp	63	31%	iau53 pu53 ʐan35 ⟶ iaup53 ʐan35	‘otherwise’
	V	140	69%	lio53 pau55 ⟶ 1iau55	‘six packs’
	Total	203	100%		

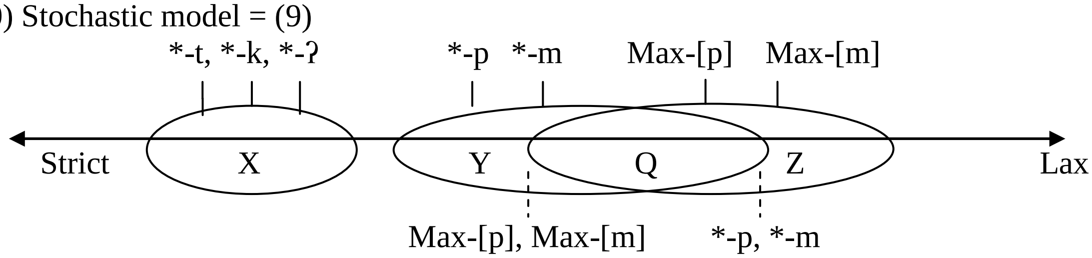
V stands for vowel. (8a) shows that there are 355 contracta that are combined from an open syllable and a following syllable that has a [k]-onset; none of them derives a [k]-coda, found in 0%, but all the [k]s are deleted, found in 100%. In (8b), there are 208 contracta that are combined from an open syllable and a following syllable that has a [t]-onset; none of them derives a [t]-coda, found in 0%, but all the [t]s are deleted, found in 100%. In (8c), there are 208 contracta that are combined from an open syllable and a following syllable that has a glottal stop onset; none of them derives a glottal stop coda, found in 0%, but all the glottal stops are deleted, found in 100%. On the other hand, (8d) shows that there are 126 contracta that are combined from an open syllable and a following syllable that has an [m]-onset; all of them derive an [m]-coda, found in 100%. As to (8e), there are 203 contracta that are combined from an open syllable and a following syllable that has a [p]-onset; 63 of them derive a [p]-coda, found in 31%, while 140 drop the [p], found in 69%.

A constraint ranking can be observed in (9), where *-t, *-k, *-ʔ and *-p dominate Max-Onset, which then dominates *-m.

(9) Constraint ranking: *-t, *-k, *-ʔ, *-p >> Max-[p], Max-[m] >>*-m

The constraint *-p dominates Max-Onset at most times, as 69% of the contractions in (7e) drop the [p] to avoid a [p]-coda. However, there are times when *-p is outranked by Max-Onset, as 31% of the contractions in (8e) derive a [p]-coda. The scale in (10) shows that the constraint ranking in (9) is not totally categorical, as the ranges Max-Onset and *-p may overlap.

(10) Stochastic model = (9)



Q indicates the overlapped area of Max constraints and coda conditions, where the ranking of these two types of constraints may be reversed; in that event, [p] and [m] may surface as codas. The question is why only [m] and [p] may be contracted as codas. In fact, Mandarin allows nasal codas such as [n] and [ŋ]. It is understandable that syllable contraction tolerates the [m]-coda more than the obstruent codas. As the [p]-coda, it is essentially contracted from the negator [pu], as will be discussed next.

5. Reinvestigation of Mandarin X-not-X contraction

An earlier investigation of X-not-X is in Cheng (2011). He discovers that in syllable contraction, the [p]-onset in the negator [pu] may surface as part of the following onset or the preceding coda. In my research, I reinvestigate the X-not-X contraction on a corpus basis. The present corpus includes syllable contractions from Adj-not-Adj and Verb-not-Verb. First of all, table (11) shows the relevant statistics of the [-V pu V-] contraction. (V stands for vowel)

(11) -V + pu + V-

S	C	T	%	G
a. ɤ53 pu35 ɤ53	ɤ53 pɤ53	1	12.5%	‘hungry or not’
	ɤ53 puɤ353	4	50.0%	
	ɤp53 ɤ353	3	37.5%	
	Total	8	100.0%	
b. ai53 pu35 ai53	ai53 pai53	1	12.5%	‘love (it) or not’
	ai53 puai353	5	62.5%	
	aip53 ai53	2	25.0%	
	Total	8	100.0%	
c. ua55 pu53 ua55	ua55 pua55	7	87.5%	‘dig (it) or not’
	uap55 ua55	1	12.5%	
	Total	8	100.0%	
d. iau53 pu35 iau53	iau53 piau353	7	87.5%	‘want (it) or not’
	iaup53 iau53	1	12.5%	
	Total	8	100.0%	

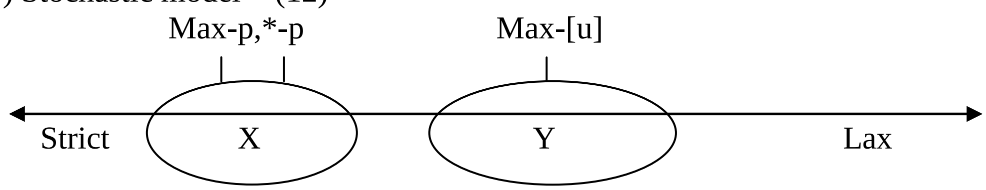
As shown in (11a), when the preceding syllable ends in a single vowel, 1 out of the 8 speakers preserves [p] in the following onset, found in 12.5%; 4 preserve [pu] in the following syllable, found in 50%; while 3 of them derive a [p]-coda, found in 37.5%. In (11b), the preceding syllable ends in a falling diphthong, and also only 1 out of the 8 speakers preserves [p] in the following onset, found in 12.5%; 5 preserve [pu] in the following syllable, found in 50%, while 2 of them derive a [p]-coda, found in 37.5%. (11c) shows that the preceding syllable ends in a rising diphthong, and 7 out of the 8 speakers preserve [pu] in the following syllable, found in 87.5%; only 1 of them derives a [p]-coda, found in 12.5%. In (11d), the preceding syllable ends in a triphthong, and 7 out of the 8 speakers preserve [p] in the following onset, found in 87.5%; while only 1 of them derives a [p]-coda, found in 12.5%.

A constraint ranking can be observed in (12), where Max-[p] and *-p dominate Max-u.

(12) Constraint ranking: Max-[p],*-p >> Max-[u]

The scale in (13) shows that the constraint ranking is categorical, since no ranges of the points overlap.

(13) Stochastic model = (12)



An interesting pattern observed in Table (11) is that the [u] vowel of the negator [pu] is sometimes truncated, while the [p] consonant is always preserved in syllable contraction. The question is why the major semantic content of the source syllables is retained not by way of keeping the vowel, the most sonorant element of [pu], but by way of keeping the less sonorant obstruent. The reason lies in the application of neutral tone: the negator [pu] is often neutral-toned, in which case, [u] is unstressed and less sonorant, and thus is easier to be truncated.

Table (14) shows the statistics of the [-V pu CV-] contraction.

(14) -V + pu + CV-

S	C	T	%	G
a. ʂɨ55 pu53 ʂɨ55	ʂɨ55 puɨ55	2	25%	‘wet or not’
	ʂɨ55 pʂɨ55	0	0%	
	ʂɨp55 ʂɨ55	6	75%	
	Total	8	100%	
b. ta21 pu53 ta21	ta21 pua51	0	0%	‘hit (it) or not’
	tap21 pta51	0	0%	
	tap25 ta21	8	100%	
	Total	8	100%	
c. tɕ^{h}i53 pu35 tɕ^{h}i53	tɕ^{h}i53 ptɕ^{h}i53	0	0%	‘angry or not’
	tɕ^{h}ip53 tɕ^{h}i53	8	100%	
	Total	8	100%	
d. mai53 pu35 mai53	mai53 pmai53	0	0%	‘sell (it) or not’
	maip53 mai53	8	100%	
	Total	8	100%	

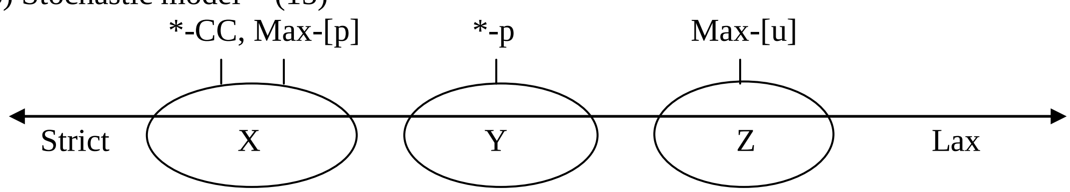
(14a) shows that the negator [pu] is followed by a fricative, 2 out of the 8 speakers preserves [pu] in the following syllable, found in 12.5%; none of the them derives a consonant onset cluster, found in 0%, while 6 of them derive a [p]-coda, found in 75%. In (14b), [pu] is followed by a stop, and all of the 8 speakers derive a [p]-coda, found in 100%. In (14c), [pu] is followed by an affricate, and all of the 8 speakers derive a [p]-coda, found in 100%. In (14d), [pu] is followed by a nasal, and all of the 8 speakers derive a [p]-coda as well, found in 100%.

The contractions in (14) show that [p] is more likely to occur as a coda than to join the following onset to form a cluster. A constraint ranking can be observed in (15), where *-CC and Max-p dominate *-p, while Max-[u] is ranked at the bottom.

(15) Constraint ranking: *-CC, Max-[p] >> *-p >> Max-[u]

The scale in (16) shows that the constraint ranking is categorical, since no ranges of the points overlap.

(16) Stochastic model = (15)



Mandarin disallows consonant clusters. The constraint *CC is top-ranked in this language, even in syllable contraction. When the negator [pu] is followed by a CV syllable, the high-ranking of *CC prevents [p] from forming a consonant cluster with the following onset. Consequently, [p] always emerges as the coda of the preceding syllable, and the constraint *-p is suppressed.

Table (18) shows the tendency of the [-VN pu CV-] contraction.

(17) -VN + pu + CV-

	S	C	T	%	G
a.	sin55 pu53 sin55	sin55 psin55	0	0%	‘new or not’
		sip55 sin55	0	0.0%	
		sim55 sin55	8	100.0%	
		Total	8	100.0%	
b.	toŋ21 pu53 toŋ21	toŋ21 ptoŋ51	0	0.0%	‘get (it) or not’
		toŋ21 puoŋ51	3	37.5%	
		tom25 toŋ21	5	62.5%	
		top25 toŋ21	0	0.0%	
		Total	8	100.0%	

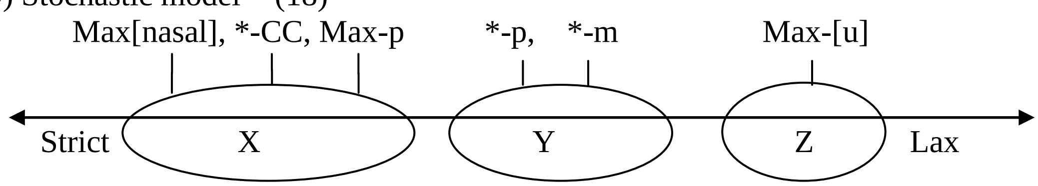
(17a) shows that when [pu] is preceded by an alveolar nasal coda, all of the 8 speakers derive a [m]-coda, where [n] and [p] merge into [m], found in 100%. In (17b), [pu] is preceded by a velar nasal coda, and 3 of the 8 speakers replace [t] with [p] as the onset and preserve the [ŋ]-coda, found in 37.5%; 5 of them derive a [m]-coda, where [ŋ] and [p] merge into m, found in 62.5%.

The contractions in (17) show that the [nasal] feature of the coda is always retained, whereby a [m]-coda may be derived. The constraint ranking can be enriched as (18), where Max[nasal], *-CC and Max-p dominate *-p and *-m, while Max-[u] is ranked at the bottom.

(18) Constraint ranking: Max[nasal], *-CC, Max-p >> *-p, *-m >> Max-[u]

The scale in (19) shows that the constraint ranking is categorical, since no ranges of the selected points overlap.

(19) Stochastic model = (18)



The top-ranking of *CC bans consonant clusters not only in onset position but also in coda position; coda clusters like [np] or [ŋp] are disallowed. This fact makes possible the merger of the nasal and [p] in coda position, where the illegitimate [m]-coda emerges and the constraint *-m is suppressed.

Finally, consider table (20), which shows the statistics of the [-VN pu V-] contraction.

(20) -VN + pu + V-

S	C	T	%	G
a. un55 pu35 un53	un53 pun35	5	62.5%	'ask or not'
	um53 un53	1	12.5%	
	um53 pun35	2	25.0%	
	Total	8	100.0%	
b. uaŋ53 pu35 uaŋ53	uaŋ53 puaŋ35	7	87.5%	'vigorous or not'
	uam53 uaŋ35	0	0.0%	
	uam53 puaŋ35	1	12.5%	
	Total	8	100.0%	

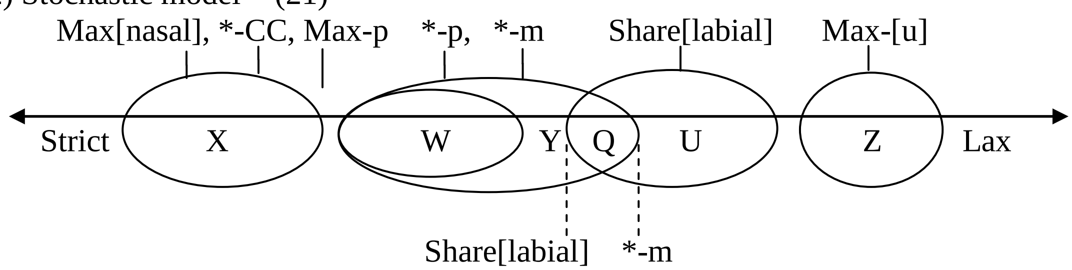
(20a) shows that when [pu] is preceded by an alveolar nasal coda and followed by an onsetless syllable, 5 of the 8 speakers derive a [p]-onset and preserve the [n]-coda, found in 62.5%; 1 of them derives a [m]-coda, where [n] and [p] merge into [m], found in 12.5%; 2 of them derive a [p]-onset and a [m]-coda, where [n] assimilates to p, found in 25%. (20b) shows that preceded by a velar nasal coda and followed by an onsetless syllable, 7 of the 8 speakers derive a p-onset and preserve the ŋ-coda, found in 62.5%; 1 of them derives a p-onset and a m-coda, where ŋ assimilates to p, found in 25%.

The contractions in (20) show that the preceding nasal coda may assimilates to the place of [p], whereby a [m]-coda may be derived. The constraint ranking can be enriched as (21), where Max[nasal], *-CC and Max-p dominate *-p and *-m, which then dominates Share[labial], and Max-[u] is ranked at the bottom.

(21) Constraint ranking:
Max[nasal], *-CC, Max-p >> *-p, *-m >> Share[labial] >> Max-[u]

The scale in (22) shows that the ranges of *-m and Share[labial] overlap, as indicated by Q. In the Q area, Share[labial] may outranks *-m, whereby assimilation occurs, as in (19) above.

(22) Stochastic model = (21)



In Mandarin, a nasal coda sometimes assimilates to the place of a following onset; /taŋ ʐan/ ‘of course’ often surfaces as [tan ʐan], and /nan kau/ ‘hard to handdle’ sometimes surfaces as [naŋ kau]. However, /kan ku/ ‘dry out’ can not surface as [kaŋ ku]. The constraint *-m usually dominates Share[labial] in this language, but this constraint ranking may often be reversed in syllable contraction. When the negator [pu] follows a nasal coda, [n] or [ŋ], and precedes an onsetless syllable, the nasal coda, in most cases, is not affected by the following [p]-onset, where *-m dominates Share[labial], but in some of cases, the nasal coda may be labialized as [m], where Share[labial] dominates *-m.

6. Summary

In summary, I have shown that phonotactic constraints on diphthongs, such as *ei, *ie, *ou and *uo, are violable in Taiwanese and Sixian Hakka. In Mandarin, phonotactic constraints on codas, such as *-m and *-p, are violable in Mandarin, but *-t, *-k and *-ʔ

are inviolable. In X-not-X contraction, [p] may join the following onset or the preceding coda, or merge with the preceding nasal coda, observing constraints such as Max[nasal], *-CC and Max-[p]. The constraint *-m usually dominates Share[labial] in Mandarin, but this constraint ranking may often be reversed in syllable contraction. Generally speaking, violations of the phonotactic constraints in syllable contraction arise from the purpose of preserving the semantic content of the source syllables. Further research may explore the syllable contraction in terms of onsets, onset-nucleus sequences, nucleus-coda sequences, tone combinations, in addition to more types of vocalic combinations and codas.

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