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Intonational Phrasing in Zhuolan Raoping

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This paper constructs a corpus of tone sandhi of Zhuolan Raoping, and discusses intonational phrasing in this Hakka dialect. While examining the strict layer hypothesis, this research observes that the intonational phrase (ι) is not sensitive to the formation of sense unit. The corpus also indicates that the ι-length is under restrictions. I have proposed a constraint ranking under the standard prosodic theory, and shown that the match theory is not well-motivated and may result in incorrect predictions.

0. Introduction

This paper discusses the intonational phrasing in Zhuolan Raoping, a Hakka dialect spoken in central Taiwan. I will first address the theoretical background and the tonal basics of this dialect. I will then explain the corpus I built in this research, and propose an analysis. Finally I will comment on an alternative analysis, and then offer a conclusion.

1. Standard prosodic theory

The partial hierarchy in (1) is posited by the Standard Prosodic Theory (Nespor and Vogel 1986, Hayes 1989, Hsiao 1991, among others). An intonational phrase consists of one or more phonological phrases, and a phonological phrase consists of one or more phonological words.

(1) Prosodic Hierarchy

ι	Intonational Phrase
φ	Phonological Phrase
ω	Phonological Word

The Strict Layer Hypothesis in (2) is a constraint for the prosodic hierarchy (Nespor and Vogel 1986, Hayes 1989, Hsiao 1991, among others). A prosodic constituent at a given level of the hierarchy is composed of constituent(s) at the next lower level of the hierarchy. There is no recursion, inversion, nor skipping of prosodic level.

(2) Strict Layer Hypothesis
There is a hierarchy of prosodic constituent types such that, in a prosodic tree, any constituent at a given level of the hierarchy consists exclusively of constituents at the next lower level of the hierarchy.

Selkirk (1986) posits four end-based parameters to construct a phonological phrase, as in (3); namely, a phonological phrase boundary is marked at the right or left edge of an XP or X^{head}.

(3) Phonological Phrasing (Selkirk 1986)
φ = XP], [XP, X^{head}], [X^{head}

In Hsiao (1991, 1995), as in (4) and (5), I observed that a phonological phrase boundary in Taiwanese is marked at the right edge of a non-adjunct and non-clitic XP (cf. also Chen 1987, 2000).

(4) Phonological Phrasing (Hsiao 1991)
φ = {Right, XP^{-a}} where –a = non-adjunct

(5) Phonological Phrasing (Hsiao 1995)
φ = {Right, $XP^{-a \wedge -c}$} where –a = non-adjunct; –c = non-clitic

There are also some proposals regarding intonational phrasing. Selkirk (1984) suggests that the immediate constituents of an intonational phrase may be grouped into a sense unit, as in (6). She proposes a Sense Unit Condition, which considers that two constituents may form a sense unit if they show a modifier-head relation or an argument-head relation, as in (7).

(6) Intonational Phrasing (Selkirk 1984)
The immediate constituents of an intonational phrase must together form a sense unit.

(7) Sense Unit Condition: (Selkirk 1984)
Two constituents C_i, C_j form a sense unit if (a) or (b) is true of the semantic interpretation of the sentence:
a. C_i modifies C_j (a head)
b. C_i is an argument of C_j (a head)

In (8), Nespor and Vogel (1986) follow the Strict Layer Hypothesis and indicate that phonological phrases are grouped into an intonational phrase, and in (9), they suggest that there is a preference of constructing intonational phrases of average length.

(8) Intonational Phrasing (Nespor and Vogel 1986)
Join into an n-ary branching ι all φs included in a string delimited by the definition of the domain of ι.

(9) ι-Length (Nespor and Vogel 1986)
There is a tendency to establish ι's of a more or less uniform, average length.

2. Tonal basics

There are six base tones in Zhuolan Raoping, including three high-register tones and three low-register tones, as in (10). In addition, there is a derived mid tone that occurs only in the surface, as in (11). The rule in (12) shows that high-falling, high-level and low-falling map to mid before any low-register tone, but they map to low before any high-register tone. The low-level, 11, does not undergo tone sandhi.

(10) Tone inventory
High-registered: 55, 53 and 5̲
Low-registered: 11, 31 and 2̲ (where checked tones are underlined)

(11) Derived tone
High-registered: 33

(12) Tone sandhi

$$\left\{\begin{matrix}53\\55\\31\end{matrix}\right\} \longrightarrow 33 \,/\, \_\_\_\_ \left\{\begin{matrix}11\\31\\\underline{2}\end{matrix}\right\}$$

$$\longrightarrow 11 \,/\, \_\_\_\_ \left\{\begin{matrix}53\\55\\\underline{5}\end{matrix}\right\}$$

3. The corpus

In this research, I build a corpus of Zhuolan Raoping, with the help of two male informants, both aged 64. The corpus contains 428 pentasyllabic line tokens, 112 hexasyllabic line tokens, and 571 longer line tokens. There are 4,414 syllable tokens in total. The tone occurrences in the data are coded with different structures, as in (13). (13a) indicates an SU-final, a non-adjunct XP-final and line final position. (13b) indicates an SU-final and a non-adjunct XP-final but not line final position. (13c) indicates an SU-final and adjunct XP-final but not a line final position. (13d) indicates SU-final or non-final.

(13) Structural coding:
- a. $)^{SU}\ ]^{XP\text{-}a}\ ]^{LF}$: SU-final, non-adjunct XP-final and line final position.
- b. $)^{SU}\ ]^{XP\text{-}a}$: SU-final and non-adjunct XP-final but not line final position.
- c. $)^{SU}\ ]^{XP+a}$: SU-final and adjunct XP-final but not line final position.
- d. Y:
  - d.1 $)^{SU}$: SU-final and non-XP-final but not line final position.
  - d.2 Z: non-SU-final, non-XP-final and not line final position.

An example is given in (14), where there are two possible ways to parse the sense units. For this line, we obtained two actual renderings, as in (14a) and (14b). (15a) and (15b) show how the tone occurrences in (14a) and (14b) are counted respectively. (16) is the sum of (15a) and (15b).

(14) $[lo\ moi]^{NP}\ [da\ \ [ten\ fa]^{NP}\ ]^{VP}$

	老 妹	打	電 話	
	sister	call	phone	'My sister called.'
	31 31	31	55 55	Input
	( )	(	( ))	SU pattern 1
	(( )	)	( )	SU pattern 2
a.	33 31 /P	11	33 55 /P	Actual rendering 1
b.	33 31	11	33 55 /P	Actual rendering 2
	33 31	11 /P	33 55 /P	Unacceptable

(15) Instances of calculating

a. = (14a)

	Words	B	S	Total	Percentage	/P
$)^{SU}\ ]^{XP\text{-}a}\ ]^{LF}$	*fa* 話	1	0	1	20%	1
$)^{SU}\ ]^{XP\text{-}a}$	*moi* 妹	1	0	1	20%	1
$)^{SU}\ ]^{XP+a}$						
Y	*lo* 老, *da* 打, *ten* 電	0	3	3	60%	0
Total		2	3	5	100%	2
Percentage		40%	60%	100%		

b. = (14b)

	Words	B	S	Total	Percentage	/P
$)^{SU}\ ]^{XP\text{-}a}\ ]^{LF}$	*fa* 話	1	0	1	20%	1
$)^{SU}\ ]^{XP\text{-}a}$	*moi* 妹	1	0	1	20%	0
$)^{SU}\ ]^{XP+a}$						
Y	*lo* 老, *da* 打, *ten* 電	0	3	3	60%	0
Total		2	3	5	100%	1
Percentage		40%	60%	100%		

(16) Sum of (15a) + (15b)

	Words	B	S	Total	Percentage	/P
)^{SU}]$^{XP\text{-}a}$]^{LF}	*fa* 話	2	0	2	20%	2
)^{SU}]$^{XP\text{-}a}$	*moi* 妹	2	0	2	20%	1
)^{SU}]$^{XP+a}$						
Y	*lo* 老, *da* 打, *ten* 電	0	6	6	60%	0
Total		4	6	10	100%	3
Percentage		40%	60%	100%		

Another example is given in (17), where there are also two possible ways to parse the sense units. For this line, we obtained three actual renderings, as in (17a-c). (18a-c) show how the tone occurrences in (17a-c) are counted respectively. (19) is the sum of (18a-c).

(17) [*lo moi*]^{NP} [*teu ha*]^{AdvbP} [*gong* [*oi shid pon*]^{VP}]^{VP}

	老 妹	頭 下	講	愛 食 飯
	Sister	just	say	like eat meal ‘My sister just said she wanted to eat.’
	31 31	53 55	31	31 <u>5</u> 55 Input
	( )	( )	(	(( ))) SU pattern 1
	( )	(( )	)	(( )) SU pattern 2
a.	33 31 /P	33 55 /P	33	33 <u>2</u> 55 /P Actual rendering 1
b.	33 31	33 55 /P	33	33 <u>2</u> 55 /P Actual rendering 2
c.	33 31	33 55	33	33 <u>2</u> 55 /P Actual rendering 3
d.	33 31 /P	33 55	33	33 <u>2</u> 55 /P Marginal
e.	33 31	33 55	33 /P	33 <u>2</u> 55 /P Unacceptable

(18) Instances of calculating

a. = (17a)

	Words	B	S	Total	Percentage	/P
)^{SU}]$^{XP\text{-}a}$]^{LF}	*pon* 飯	1	0	1	12.5%	1
)^{SU}]$^{XP\text{-}a}$	*moi* 妹	1	0	1	12.5%	1
)^{SU}]$^{XP+a}$	*ha* 下	1	0	1	12.5%	1
Y	*lo* 老, *teu* 頭, *gong* 講, *oi* 愛, *shid* 食	0	5	5	62.5%	0
Total		3	5	8	100.0%	3
Percentage		37.5%	62.5%	100%		

b. = (17b)

	Words	B	S	Total	Percentage	/P
)^{SU}]$^{XP\text{-}a}$]^{LF}	*pon* 飯	1	0	1	12.5%	0
)^{SU}]$^{XP\text{-}a}$	*moi* 妹	1	0	1	12.5%	1
)^{SU}]$^{XP+a}$	*ha* 下	1	0	1	12.5%	1
Y	*lo* 老, *teu* 頭, *gong* 講, *oi* 愛, *shid* 食	0	5	5	62.5%	0
Total		3	5	8	100.0%	2
Percentage		37.5%	62.5%	100%		

c. = (17c)

	Words	B	S	Total	Percentage	/P
)^{SU}]$^{XP\text{-}a}$]^{LF}	*pon* 飯	1	0	1	12.5%	1
)^{SU}]$^{XP\text{-}a}$	*moi* 妹	1	0	1	12.5%	0
)^{SU}]$^{XP+a}$	*ha* 下	1	0	1	12.5%	0
Y	*lo* 老, *teu* 頭, *gong* 講, *oi* 愛, *shid* 食	0	5	5	62.5%	0
Total		3	5	8	100.0%	1
Percentage		37.5%	62.5%	100%		

(19) Sum of (17a) + (17b) + (17c)

	Words	B	S	Total	Percentage	/P
)^{SU}]$^{XP\text{-}a}$]^{LF}	*pon* 飯	3	0	3	12.5%	3
)^{SU}]$^{XP\text{-}a}$	*moi* 妹	3	0	3	12.5%	1
)^{SU}]$^{XP+a}$	*ha* 下	3	0	3	12.5%	2
Y	*lo* 老, *teu* 頭, *gong* 講, *oi* 愛, *shid* 食	0	15	15	62.5%	0
Total		9	15	24	100.0%	6
Percentage		37.5%	62.5%	100%		

(20) shows the total number of tones occurring in difference structures. The parentheses indicate the numbers of the low-level tone.

(20) Statistics including 11

	B	S	Total	Percentage	/P
$)^{SU}\ ]^{XP\text{-}a}\ ]^{LF}$	648 (165)	66 (0)	714 (165)	16.18%	3
$)^{SU}\ ]^{XP\text{-}a}$	744 (68)	131 (3)	875 (71)	19.82%	1
$)^{SU}\ ]^{XP+a}$	73 (8)	52 (3)	125 (11)	2.83%	2
Y	751 (556)	1923 (55)	2674 (611)	60.57%	0
Total	2305 (797)	2109 (61)	4414 (858)	100.0%	6
Percentage	52.22%	47.78%	100%		

The low-level tone, 11, is irrelevant to tone sandhi, and thus the occurrences of this base tone are deducted, as in (21a-d), which show accurate statistic numbers and percentages of tone sandhi.

(21) Statistics excluding 11

a. SU-final, non-adjunct XP-final and line final

	B	S	Total
$)^{SU}\ ]^{XP\text{-}a}\ ]^{LF}$	483	66	549
Percentage	87.98%	12.02%	100%

b. SU-final and non-adjunct XP-final but not line final

	B	S	Total
$)^{SU}\ ]^{XP\text{-}a}$	676	128	804
Percentage	84.08%	15.92%	100%

c. SU-final and non-adjunct XP-final but not line final

	B	S	Total
$)^{SU}\ ]^{XP+a}$	65	49	114
Percentage	57.02%	42.98%	100%

d. SU-final or non-final

	B	S	Total
Y	195	1868	2063
Percentage	9.45%	90.55%	100%

4. Proposed analysis

In this section, I propose an analysis using standard prosodic theory and general alignment. But before that, several patterns are observed from the corpus. First, line-final tones mostly retain their base forms, found in 87.98% of the data. Second, non-adjunct XP-final tones mostly retain their base forms, found in 84.08% of the data. Third, half of the adjunct XP-final tones retain their base forms, found in 57.02% of the data, while half

of them surface with their sandhi forms, found in 49.98% of the data. Fourth, the formation of sense unit does not affect tone sandhi; a SU-final tone surfaces with its sandhi form. Fifth, a pause may optionally occur after an XP. Sixth, a pause cannot be preceded by a sandhi tone, but base tone is not necessarily followed by a pause. Finally, the length difference between the established ι's within an utterance is no more than three syllables. Based on the corpus, I propose a set of constraints in (22), and a partial constraint ranking is proposed in (23).

(22) Constraints

a. ALIGN-R(φ, XP^{-a}): assign one violation mark for every phonological phrase, φ, whose right edge does not coincide with the right edge of a non-adjunct XP.
b. ALIGN-R(φ, XP^{+a}): assign one violation mark for every phonological phrase, φ, whose right edge does not coincide with the right edge of an adjunct XP.
c. ALIGN-R(ι, φ): assign one violation mark for every intonational phrase, ι, whose right edge does not coincide with the right edge of a phonological phrase, φ.
d. ALIGN-R(ι, B): assign one violation mark for every intonational phrase, ι, whose right edge does not coincide with the right edge of a base tone, B.
e. *S/P: assign one violation mark for every pause, P, which is preceded by a sandhi tone, S.
f. ι-RHYTHM: assign one violation mark for every pair of intonational phrases, ι's, who lengths differ in four syllables or more.

(23) Constraint ranking

*S/P, ALIGN-R(ι, B), ALIGN-R(ι, φ) >> ι-RHYTHM

Tableaux (24) and (25) show how this analysis works.

(24) [lo moi]^{NP} [*da* [*ten fa*]^{NP}]^{VP}

		*S/P	ALIGN-R (ι, B)	ALIGN-R (ι, φ)	ι-RHYTHM
☞a.	((*lo moi*)$_{φ}$)$_{ι\ /P}$ ((*da ten fa*)$_{φ}$)$_{ι\ /P}$ S B S S B				
☞b.	((*lo moi*)$_{φ}$ (*da ten fa*)$_{φ}$)$_{ι\ /P}$ S B S S B				
c.	((*lo moi*)$_{φ}$ *da*)$_{ι\ /P}$ ((*ten fa*)$_{φ}$)$_{ι\ /P}$ S B S S B	*(!)	*(!)	*(!)	

(25) [*lo moi*]^{NP} [*teu ha*]^{AdvbP} [*gong* [*oi shid pon*]^{VP}]^{VP}

		*S/P	ALIGN-R(ι, B)	ALIGN-R(ι, φ)	ι-RHYTHM
☞a.	((*lo moi*)$_{φ}$)$_{ι\ /P}$ ((*teu ha*)$_{φ}$)$_{ι\ /P}$ ((*gong oi shid pon*)$_{φ}$)$_{ι\ /P}$ S B S B S S S B				
☞b.	((*lo moi*)$_{φ}$ (*teu ha*)$_{φ}$)$_{ι\ /P}$ ((*gong oi shid pon*)$_{φ}$)$_{ι\ /P}$ S B S B S S S B				
☞c.	((*lo moi*)$_{φ}$ (*teu ha*)$_{φ}$ (*gong oi shid pon*)$_{φ}$)$_{ι\ /P}$ S B S B S S S B				
d.	((*lo moi*)$_{φ}$)$_{ι\ /P}$ ((*teu ha*)$_{φ}$ (*gong oi shid pon*)$_{φ}$)$_{ι\ /P}$ S B S B S S S B				*!
e.	((*lo moi*)$_{φ}$ (*teu ha*)$_{φ}$ *gong*)$_{ι\ /P}$ ((oi shid pon)$_{φ}$)$_{ι\ /P}$ S B S S S S B	*(!)	*(!)		

In (24), candidate (c) can be ruled out by any of the higher-ranked constraints, and then candidates (a) and (b) are both selected. In (25), candidate (e) can be ruled out either by star sandhi tone pause or align base tone; candidate (d) is ruled out by I-rhythm, and then candidates (a), (b) and (c) emerge.

5. Alternative analysis

At this moment, we can consider an alternative analysis using Selkirk's Match theory. This theory proposes that there is a tendency for prosodic constituents to mirror syntactic constituents. In this sense, the syntax-prosody match is no longer a matter of alignment but operates on correspondence. Selkirk's match constraints are given in (26), which require a match between phonological phrase and XP, and between intonational phrase and clause. A constraint ranking can be posited as (27).

(26) Constraints

a. MATCH(φ, XP): assign one violation mark for every phonological phrase, φ, that is not matched by a corresponding XP.
b. MATCH(XP, φ): assign one violation mark for every XP that is not matched by a corresponding phonological phrase, .
c. MATCH(ι, CL): assign one violation mark for every intonational phrase, ι, that is not matched by a corresponding clause.
d. MATCH(CL, ι): assign one violation mark for every clause that is not matched by a corresponding intonational phrase, ι.

(27) Constraint ranking
*S/P >> MATCH(CL, ι) >> MATCH(ι, CL) >> ι-RHYTHM

Tableaux (28) and (29) show that under this analysis, an illegal output can be wrongly selected, while the real optimal output can be wrongly ruled out. The symbol 👎 indicates a wrongly selected output, while the symbol *☞ indicates the real optimal output that is wrongly ruled out.

(28) [*lo moi*]^{NP} [*da* [*ten fa*]^{NP}]^{VP}

		*S/P	MATCH (CL, ι)	MATCH (ι, CL)	ι-RHYTHM
*☞a.	((*lo moi*)$_{φ}$)$_{ι\ /P}$ ((*da ten fa*)$_{φ}$)$_{ι\ /P}$ S B S S B		*!	**	
☞b.	((*lo moi*)$_{φ}$ (*da ten fa*)$_{φ}$)$_{ι\ /P}$ S B S S B				
c.	((*lo moi*)$_{φ}$ *da*)$_{ι\ /P}$ ((*ten fa*)$_{φ}$)$_{ι\ /P}$ S B S S B	*!	*	*	

(29) [*lo moi*]^{NP} [*teu ha*]^{AdvbP} [*gong* [*oi* [*shid pon*]^{NP}]^{VP}]^{VP}

		*S/P	MATCH (CL, ι)	MATCH (ι, CL)	ι-RHYTHM
*☞a.	((*lo moi*)$_{φ}$)$_{ι\ /P}$ ((*teu ha*)$_{φ}$)$_{ι\ /P}$ ((*gong* (*oi* (*shid pon*)$_{φ}$)$_{φ}$)$_{φ}$)$_{ι\ /P}$ S B S B S S S B		*!	**	
*☞b.	((*lo moi*)$_{φ}$ (*teu ha*)$_{φ}$)$_{ι\ /P}$ ((*gong* (*oi* (*shid pon*)$_{φ}$)$_{φ}$)$_{φ}$)$_{ι\ /P}$ S B S B S S S B		*!	*	
☞c.	((*lo moi*)$_{φ}$ (*teu ha*)$_{φ}$ (*gong* (*oi* (*shid pon*)$_{φ}$)$_{φ}$)$_{φ}$)$_{ι\ /P}$ S B S B S S S B				
d.	((*lo moi*)$_{φ}$)$_{ι\ /P}$ ((*teu ha*)$_{φ}$ (*gong* (*oi* (*shid pon*)$_{φ}$)$_{φ}$)$_{φ}$)$_{ι\ /P}$ S B S B S S S B		*!	**	*
e.	((*lo moi*)$_{φ}$ (*teu ha*)$_{φ}$ *gong*)$_{ι\ /P}$ ((*oi* (*shid pon*)$_{φ}$)$_{φ}$)$_{ι\ /P}$ S B S S S S B	*!	*		

6. Conclusion

An intonational phrase consists of one or more phonological phrases, and thus ends in a base tone. Intonational phrasing is not sensitive to the formation of sense unit. A pause cannot occur after a sandhi tone. The corpus shows that the length difference between the established ι's within an utterance is no more than three syllables. I have proposed a constraint ranking under the standard prosodic theory, and show that the match theory is not well-motivated, and may result in incorrect predictions.

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