

Contour Tone-Induced Lengthening in Cantonese

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ABSTRACT

Current debates on the distribution of contour tones center on the issue of whether the durational properties of contour tone bearing units should be characterized in terms of phonological or phonetic parameters. Based on evidence from the phonetics of morphologically- and sandhi-derived rising toned CVVO syllables (O=obstruents) in Cantonese, this study lends support for the phonetic explanation of the durational properties of contour tone bearing units.

1. INTRODUCTION

Current debates on the distribution of contour tones center on the issue of whether the durational properties of contour tone bearing units should be characterized in terms of phonological or phonetic parameters. Duanmu [1], for example, contends that contour tones in East Asian languages are best analyzed as sequences of phonological level tones (*contra* Yip's phonemic contour approach [2]) and that each level tone occupies a distinct tone-bearing unit, in this case, a mora. He demonstrates this with data from Shanghainese, where contour toned syllables are generally twice as long as the level toned syllables. Recently, on the other hand, several studies have argued that the durational properties of contour tone syllables are better explained in terms of the phonetics of tone realization [3, 4, 5]. Drawing on his typological survey of 105 languages, Gordon [3, 4], for example, uncovers an implicational hierarchy of tone bearing ability, whereby the tolerance of contour tone on syllables which are inherently less well suited to carrying tonal information implies the tolerance of contour tones on syllables which are better suited to manifesting tone. Specifically, he found that the longer (i.e. heavy) the syllable, the better its tone bearing ability (see Figure 1).

Heavy				Light
CVV	CVR	CVO		CV

Figure 1: The implicational hierarchy of tone bearing ability (R = Sonorant; O = Obstruent).

The goals of the present study are twofold. We introduce a previous unnoticed phenomenon of contour tone-induced lengthening in Cantonese. The results of the phonetic study also allow us to evaluate the merits of the two abovementioned approaches to contour tone bearing ability. We demonstrate that underlying level toned syllables are

shorter than their derived rising toned counterparts, thus supporting the phonetic explanation of the durational properties of contour tone bearing units.

2. BACKGROUND INFORMATION

Cantonese has six tone classes. Traditional Chinese philology treats syllables with final stops (i.e. checked syllables) as distinct tone classes (i.e. checked tones), which yields nine tones instead.

(1)	Tone	Examples
	55 (~53)	si 'poetry'
	11 (21)	si 'time'
	35	si 'to send'
	13 (23)	si 'market'
	33	si 'to try'
	22 (21)	si 'affairs'
	55	sik ⁷ 'to know'
	33	se:k ⁷ 'to kiss'
	22	sik ⁷ 'to eat'

Until recently, there was also a contrast between high level and high falling. However, this distinction has collapsed for most speakers today.

Despite the standard description, rising tones in CVVO syllables, however, are found in Cantonese as the result of two distinct, characteristically colloquial, processes in the language.

2.1 MORPHOLOGICALLY-DERIVED RISING TONE

A historical, possibly marginally productive synchronic, process, known as changed tones, derives rising tones from semantically related level toned syllables (2).

(2)	Level	Gloss	Rising	Gloss
	ts ^h at ³³	'to brush'	ts ^h at ³⁵	'a brush'
	p ^h ak ³³	'to pat'	p ^h ak ³⁵	'a racket'
	kep ³³	'to clip'	kep ³⁵	'a clip'
	t ^h ok ³³	'to support'	t ^h ok ³⁵	'a stand'
	kak ³³	'to separate'	kak ³⁵	'a square'
	tʃ ^h ap ³³	'to insert'	tʃ ^h ap ³⁵	'an insert'
	tsok ²²	'to chisel'	tsok ³⁵	'a chisel'
	tip ¹¹	'to pile up'	tip ³⁵	'a plate'

As Kam [6] reported, many native speakers do not recognize any relationship between the derived forms and

its alleged base. The situation is perhaps analogous to the relationship between *brother* and *brethren* in English. However, it should be noted that the number of these changed tone derived syllables is sizable

2.2 SANDHI-DERIVED RISING TONE

Sandhi can also give rise to rising tones in Cantonese. The verbal diminutive reduplication construction in Cantonese is formed by the reduplication of a verb root, but the base and its reduplicative copy are separated by the word *jʌt˥˥* ‘one’. The medial high-level toned word, *jʌt˥˥* ‘one’, however, is often absent in conversational speech style, creating a sandhi situation. The elision of this medial syllable (i.e. *jʌt˥˥* ‘one’) causes the first syllable to change to a mid-rising tone syllable (3).

- (3) *si33 jʌt˥˥ si33* → *si35 si33* ‘to give it a try’
 (lit. try one try)
pʰat˥˥ 33 jʌt˥˥ pʰat˥˥ 33 → ‘to hit a little’
pʰat˥˥ 35 pʰat˥˥ 33 (lit. hit one hit)
tsʰaat˥˥33 jʌt˥˥ tsʰaat˥˥33 → ‘to brush a little’
tsʰaat˥˥35 tsʰaat˥˥33 (lit. brush one brush)

In the phonetic study reported below, we compare the durational properties of these morphologically- and sandhi-derived rising toned syllables with their underlying level toned counterparts. The predictions of two approaches to contour tone bearing ability are laid out below:

- The moraic analysis of contour tone bearing units [1] predicts that there should be no durational differences, since all three types of syllables are phonologically heavy, i.e. bimoraic.
- The phonetic analysis of contour tone bearing units [2, 3, 4] predicts that the derived contour tone syllables to be longer than their level toned counterparts.

3. METHODS

Two native speakers of Cantonese (a college-age male (Subject M) and a middle-age female (Subject F)) recited a list of Cantonese target syllables in the carrier phrase /ŋɔ̌ tək˥˥ ___ pɛi nei tʰæŋ/. Two sets of tokens are recorded.

Set 1: The target words were eleven doublets of CVVO Cantonese syllables. The doublets consisted of segmentally identical CVVO syllables with lexical level tones and their morphologically derived rising toned counterparts. While the derived rising tones are all mid-rising (4 or 35), the lexical level tones may be extra-low (1 or 11), low (4 or 22), or mid (4or 33) (see Appendix for the actual corpus).

- (4) Lexical level 4 (or 33)
 (tɔɔ 55) *tsʰət˥˥33* ‘to brush (more)’

Morphologically derived 4 (or 35)
 (tsuk˥˥55) *tsʰət˥˥35* ‘a (bamboo) brush’

Set 2: The target syllables are couched within the sandhi context. The target syllables consisted of eight CVVO Cantonese syllables reduplicated according to rules of the truncated diminutive reduplication construction (5).

- (5) Sandhi-derived 35
tsʰət˥˥35 tsʰət˥˥33 ‘to brush a little’

4. RESULTS

The duration of the set 1 target syllables were measured. Table 1 shows the mean durations for CVVO syllables with lexical level or morphologically derived tones for both subjects. A one-way ANOVA reveals that the duration of the CVVO syllables with the morphologically derived rising tone is significantly longer than their lexical level tone counterparts ($p < 0.05$) for both subjects (see Figure 2).

	Subject F	Subject M
Lexical Level	0.1384 (0.0229) N=33	0.1255 (0.0251) N=33
M-derived Rising	0.1631 (0.0293) N=33	0.1409 (0.0217) N=33
	($p = 0.000$)	($p = 0.010$)

Table 1: Mean durations of CVVO syllables with lexical level tones and morphological-derived rising tones.

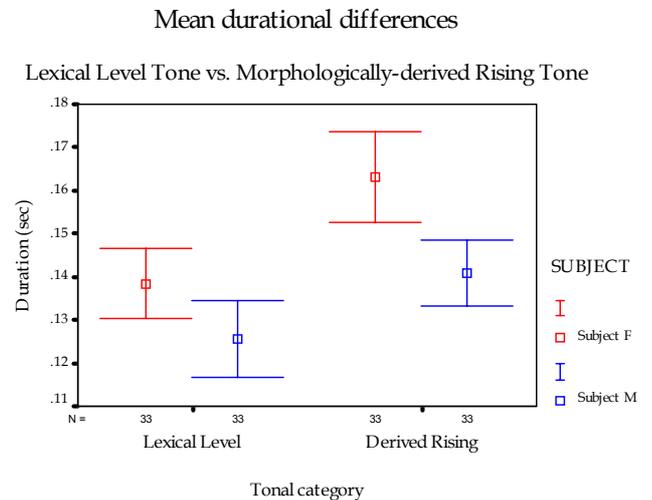


Figure 2: Mean durations of CVVO syllables with lexical level tones and morphological-derived rising tones.

To control for any speaking rate effects, the syllables with sandhi-derived rising tones (i.e. the set 2 tokens) are compared only to its following syllable, which is a copy of the target CVVO but in its original level tone (e.g., *tsʰət˥˥35 tsʰət˥˥33*). Table 2 shows the mean duration for CVVO syllables with lexical level or sandhi-derived tones for both subjects. A one-way ANOVA reveals the sandhi-derived rising toned syllables are significantly longer than its level

toned counterpart ($p < 0.05$) for both subjects (see Figure 3).

	Subject F	Subject M
Lexical level	0.1138 (0.0282) N=24	0.1100 (0.0121) N=21
S-derived Rising	0.1809 (0.0241) N=24	0.1552 (0.0176) N=24
	($p = 0.000$)	($p = 0.000$)

Table 2: Mean durations of CVVO syllables with lexical level tones and sandhi-derived rising tones

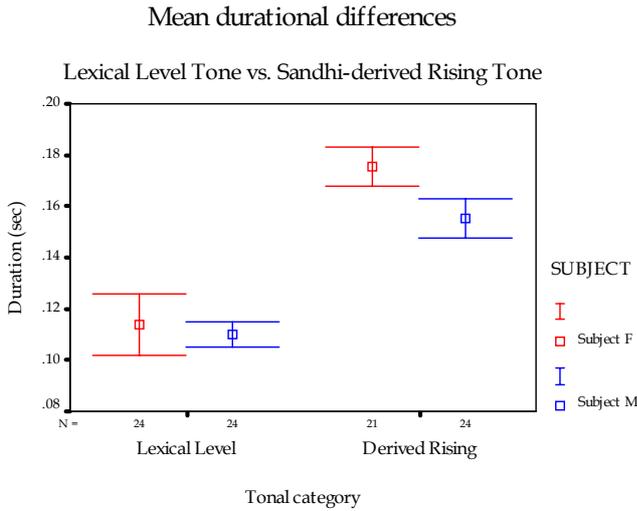


Figure 3: Mean durations of CVVO syllables with lexical level tones and sandhi-derived rising tones

The mean durational differences between the CVVO syllables with morphologically-derived and sandhi-derived rising tones are compared. A one-way ANOVA shows that, for Subject M, the sandhi-derived rising tone syllables are significantly longer than morphologically-derived ones ($p < 0.05$), while there is no significant durational difference in the speech of Subject F between these two types of derived rising toned syllables (see Figure 4).

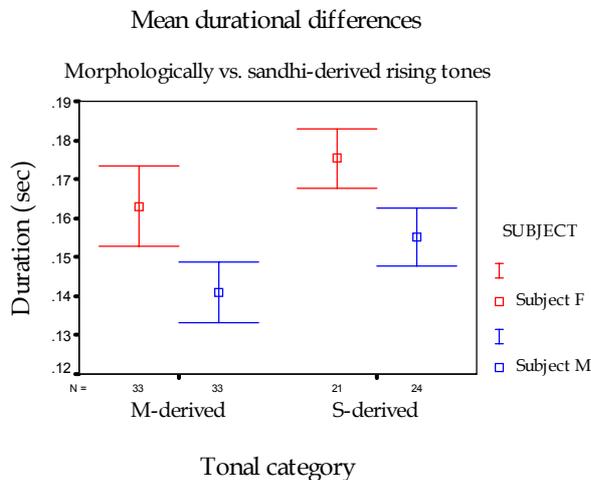


Figure 4: Mean durations of CVVO syllables with morphological (M)- and sandhi (S)-derived rising tones

5. DISCUSSIONS

The results of this experiment demonstrate that derived contour toned syllables in Cantonese are significantly longer than their underived level toned counterparts. This study, therefore, supports the phonetic explanation of the durational properties of contour tone bearing units and Gordon's implicational hierarchy. This result, however, presents an interesting challenge to the moraic theory of contour tone distribution in East Asian languages [1]: given that the standard assumption of Cantonese CVVO syllables is that they contain two moras phonologically (Cantonese also has CVO syllables, which are said to be monomoraic), it is unclear why the lengthening effect is necessary from a phonological standpoint. Such systematic micro-durational variation is not captured by this strictly phonological account.

As mentioned in the last section, the duration of the sandhi-derived rising toned syllables is significantly longer than the duration of the morphologically-derived ones in Subject M's speech. While the difference between these two types of derived syllables in Subject F's speech is not statistically significant, the overall trend, nonetheless, mimics that of Subject M. That is, Subject F's sandhi-derived rising toned syllables are generally longer than the morphologically-derived ones. *A priori*, this is unexpected, since both types of derived syllables host a type-similar rising tone, namely a 35 mid-rising tone. Several factors, however, might contribute to this disparity. First, the contexts which these two types of syllables appear are different. Following the standard metrical analysis of Cantonese phonology, the target syllables in the sandhi environment occurs in the head of a trochaic foot, but the target syllables in the derived morphological context is in the dependent position of a trochaic foot. Thus, the extra duration of the target syllables in the sandhi environment might be the result of some stress-induced lengthening effects. However, since no available study has looked at the phonetic effects of stress in Cantonese, this explanation remains speculative. The target syllables in sandhi-derived environment might also be longer due to some form of a compensatory lengthening effect due to the elision of the syllable immediately following the target syllable. Further study is underway to discern the actual mechanism(s) contributing to this durational disparity.

6. CONCLUSIONS

This study demonstrates that, in Cantonese, contour tones have a lengthening effect that is not previously observed. This result confirms the predictions of the phonetic interpretation of tone bearing ability, but presents problems for the strictly moraic approach to tonal distribution. The use of contrasts introduced by morphological and sandhi considerations in phonetic studies also provide a powerful tool to testing hypotheses in phonological and phonetic theories alike.

ACKNOWLEDGEMENTS

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APPENDIX: CANTONESE CORPUS

- (1) Lexical level tone target syllables (Target syllable is underlined)

Word	Gloss
sa:55 <u>kək</u> '33	(a place name)
tɔ:55 <u>ts^hat</u> '33	'to brush more'
tɔ:55 <u>p^hak</u> '33	'to pat more'
hæŋ55 <u>t^hək</u> '33	'to support a little'
fʌŋ55 <u>kak</u> '33	'to separate squarely'
kʌp'55 <u>t^hap</u> '33	'to insert quickly'
kʌp'55 <u>tsək</u> '22	'to chisel quickly'
fʊŋ55 <u>jip</u> '22	'maple leaf'
kwɔŋ55 <u>mək</u> '22	'a screen'
hak'55 <u>mʌk</u> '22	'black ink'
hæŋ55 <u>tip</u> '11	'to pile up gently'

- (2) Morphologically-derived mid-rising target syllables

Word	Gloss
sa:55 <u>kək</u> '35	(a type of food)
tsək'55 <u>ts^hat</u> '35	'a bamboo brush'
pɔ:55 <u>p^hak</u> '35	'a ball racket'

pui55 <u>t^hək</u> '35	'a cup stand'
fɔŋ55 <u>kak</u> '35	'a square'
kʌʌm55 <u>t^hap</u> '35	'a golden insert'
kʌʌm55 <u>tsək</u> '35	'a golden chisel'
kei55 <u>jip</u> '35	'propeller'
kɔŋ55 <u>mək</u> '35	'a liver'
hak'55 <u>mʌk</u> '35	'a mole'
kwɔŋ55 <u>tip</u> '35	'a CD'

- (3) Sandhi-derived mid-rising target syllables

Word	Gloss
ts ^h at'35 <u>ts^hat</u> '33	'to brush a little'
p ^h ak'35 <u>p^hak</u> '33	'to hit a little'
kɛp'35 <u>kɛp</u> '33	'to clip a little'
t ^h ək'35 <u>t^hək</u> '33	'to support a little'
kak'35 <u>kak</u> '33	'to separate a little'
t ^h ap'35 <u>t^hap</u> '33	'to insert a little'
tsək'35 <u>tsək</u> '22	'to chisel a little'
tip'35 <u>tip</u> '22	'to pile up a little'