

Losing identity: A study of tonal near merger in Cantonese

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The phonetic implementation system as a modular, feed-forward system (e.g., Pierrehumbert 1990, Keating 1990, Cohn 1990)

- The lexicon consists of abstract structures made up of categorical, contrastive elements.
- The phonetic implementation system relates this abstract, long-term categorical knowledge, mediated through the phonological buffer, to the phonetic implementation component, which computes the degree and timing of articulatory gestures.
- No articulatory plan can look backward to the phonological encoding, nor can the phonological encoding look back to the lexical level, (hence 'feed-forward').
- No lexical information can influence the phonetic implementation directly, bypassing the level of phonological buffering, (hence 'modular').

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Near Merger

- *Source* vs. *sauce* in New York City (Labov, Yaeger, & Steiner 1972: Ch. 6)
- *Fool* and *full* in Albuquerque (Di Paolo 1988)
- *Too* vs. *toe* and *beer* vs. *bear* in Norwich (Trudgill 1974)
- *Line* vs. *loin* in Essex (Nunberg 1980, Labov 1971)
- *Meat* vs. *mate* in Belfast (Harris 1985, Milroy & Harris 1980)

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Incomplete neutralizations

- Voicing
 - German (Port & O'Dell 1985, Port & Crawford 1989)
 - Russian (Chen 1970; Pye 1986)
 - Polish (Giannini & Cinque 1978 Slowiaczek & Dinnsen 1984)
 - Catalan (Dinnsen & Charles-Luce 1984)
 - Dutch (Warner et al. In press)
- Tonal neutralization in Mandarin (Peng 2000)

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The Skeptics

- Variable, even contradictory, results (Fourakis & Iverson 1984, Jassem & Richter 1989)
- Orthographic influence (Fourakis & Iverson 1984, Jassem & Richter 1989)
- Erroneous assumptions about the phonological representation (Mascaró 1987)
- Errors in the statistical analysis (Fourakis & Iverson 1984 vs. Port & Crawford 1989)
- *Argumentum ad ignorantium* (Ramer 1996)

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Outline

- Tonal merger in Cantonese
- Predictions of traditional models of phonetics/phonology interface.
- Production experiment
- Explaining Cantonese tonal near merger

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Why Cantonese and why tone?

- The orthography of Cantonese, if there is such a thing, does not represent tones or tonal alternations.
- Tone is not taught in school.
- Cantonese tonal merger occurs at both the morphological and post-lexical levels.

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Cantonese tonal inventory

Tone	Examples
55	si 'poetry'
21	si 'time'
25	si 'to send'
23	si 'market'
33	si 'to try'
22	si 'affairs'
55	sik [˧] 'to know'
33	se:k [˧] 'to kiss'
22	sik [˧] 'to eat'

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'Changed tones' in Cantonese

Level Tone	Gloss	Rising Tone	Gloss
sou33	'to sweep'	sou25	'a broom'
pɔŋ22	'to weigh'	pɔŋ25	'a scale'
mɔ11	'to grind'	mɔ25	'a grind'
tan22	'to pluck'	tan25	'a missile'
wɔ22	'to listen'	wɔ25	'an utterance'
jɛu11	'to grease'	jɛu25	'a stir'
liu11	'to hammer'	liu25	'a hammer'
ts ^h ɔŋ11	'to plow'	ts ^h ɔŋ25	'a plow'

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Traditional analysis: Floating H

/pɔŋ/ 'to weigh' → [pɔŋ] 'a scale'



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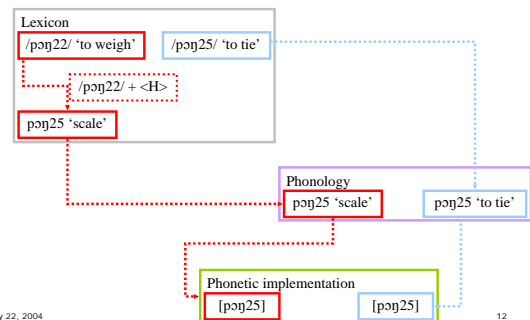
Two sources of mid-rising tones

- Lexical 25
- Morphologically-derived 25
- Phonological representation =MH

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Traditional theory of phonology/phonetic interface



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The Experiment

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Subjects

- Six native speakers of Hong Kong Cantonese (3 males and 3 females) residing in the US.
- Except for one of the male speaker (EK), all the other subjects have been in the US for less than 2 years.

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Methods

- The subjects recited a list of Cantonese disyllabic words/phrases in the carrier phrase /ŋɔ̌ wui tɔk˦ ____ pei nei tʰæŋ/ three times.
- The target (second) syllables are 10 (near) minimal pairs (i.e. with identical rhyme).
- Each target syllable has two versions (Lexical 25 vs. derived 25).
- 10 tokens x 2 versions x 3 times = 60 tokens

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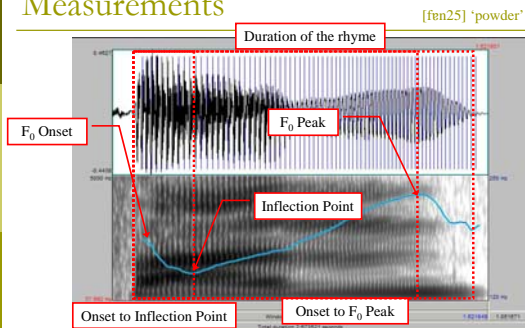
Sample stimuli

Lexical 25	Gloss	Derived 25	Gloss
søŋ55 fan25	'opposite'	ka:m55 fan25	'prisoner'
kai55 tan25	'egg'	fei55 tan25	'a missile'
pow55 pin25	'to critique'	tsʰøŋ21 pin25	'casual'
suŋ55 pøŋ25	'to untie'	tsʰuŋ23 pøŋ25	'heavy'
tsʰøŋ21 keŋ25	'long neck'	ŋjan23 keŋ25	'glasses'
fa55 fen25	'pollen'	ku25 fen25	'(stock) share'
tsʰøt˦55 pan25	'to publish'	siu25 fan25	'peddler'
tsi:22 tin25	'dictionary'	tʰiu21 kim25	'terms, conditions'

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Measurements



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The results

Subjects		DUR	F ₀ initial	F ₀ infl	F ₀ peak	To infl	To F ₀ peak
AK	$F(1, 59) =$	2.452	10.266	7.092	0.009	0.365	0.673
	$p =$	0.123	0.002	0.010	0.923	0.548	0.415
CS	$F(1, 58) =$	0.008	0.228	1.032	13.592	0.886	
	$p =$	0.927	0.635	0.314	0.001	0.351	
EK	$(1, 59) =$	0.000	0.747	10.107	7.440	3.015	0.021
	$p =$	0.983	0.391	0.002	0.008	0.088	0.885
JK	$(1, 47) =$	2.076	2.756	0.486	6.598	0.124	0.714
	$p =$	0.156	0.104	0.489	0.014	0.726	0.403
MC	$F(1, 59) =$	4.317	0.147	6.999	6.029	4.186	2.297
	$p =$	0.042	0.703	0.011	0.017	0.045	0.135
VC	$F(1, 47) =$	2.929	0.050	1.101	4.813	0.748	0.000
	$p =$	0.094	0.824	0.300	0.033	0.392	0.996

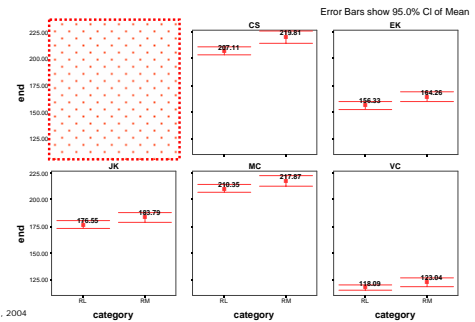
The results cont.

SUBJECT		N	Mean (Hz)	Std. Deviation
CS	RL	28	207.11	10.12
	RM	30	219.81	15.38
EK	RL	30	156.33	9.90
	RM	30	164.26	12.48
JK	RL	24	176.55	8.78
	RM	24	183.79	10.65
MC	RL	30	210.35	9.89
	RM	30	217.87	13.57
VC	RL	24	118.09	5.72
	RM	24	123.04	9.49

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RL vs. RM F₀ peaks compared



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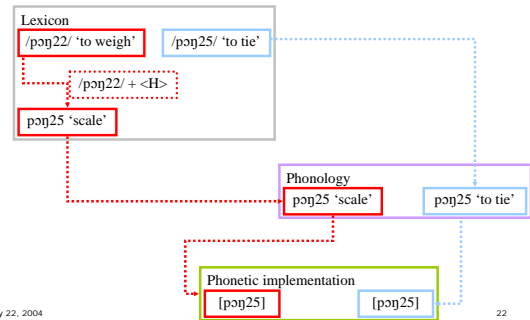
Summary

- Morphologically derived mid-rising tone differs from the lexical mid-rising tone in terms of the following:
 - the height of the F₀ peak (5 out of 6 subjects).
 - the height of the Inflection Point (3 out of 6 subjects).
- Tonal merger in Cantonese is actually an instance of **NEAR MERGER**.
- **Question:** How does this come about?

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The feed-forward modular theory of phonetic implementation provides no answers!



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Where does the changed tone come from?

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The origins of the 'changed tone'

- Changed tone as the cognate of *er*-suffixation in other Chinese dialects (Chao 1947, Whitaker 1956, Wong 1982, Jurafsky 1988)
- Lexicalized examples:
 - [mau55 ji55] 'kitten' vs. [mau55] 'cat'
 - [hak5 ji55] 'beggar' vs. [hak55] 'to beg'

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The origins of the 'changed tone'

- Changed tone as [tsi25]-suffixation
- Most of the [tsi25]-suffixed forms have an alternative form with a high rising changed tone.
 - [min22 tsi25] ~ [min25] 'face; honor'
 - [k^hei21 tsi25] ~ [k^hei25] 'a chess piece'
 - [jat2 tsi25] ~ [jat25] '(special) day'

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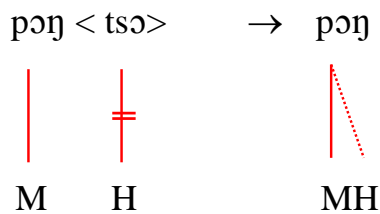
Sandhi-derived rising tones

- 得 pɔŋ22 tək55 → pɔŋ25 'to be ready to be weighed'
- fan22 tək55 → fan25 'to be ready to commit a crime'
- kin33 tək55 → kin25 'to be ready to be seen'
- 左 pɔŋ22 tsɔ25 → pɔŋ25 'to have weighed'
- fan22 tsɔ25 → fan25 'to have committed a crime'
- kin33 tsɔ25 → kin25 'to have seen'

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Sandhi as tonal reassociation



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Methods

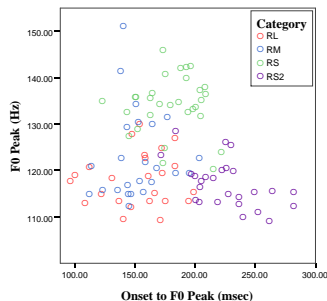
- Two subjects recited two lists of Cantonese disyllabic words/phrases in the carrier phrase /ŋɔ wui tək' ___ pɛi nei t^hæŋ/ three times.
- The first list contains ten X+ [tsɔ25] phrases.
- The first list contains ten X+ [tək55] phrases.
- X = CVN
- 10 tokens x 3 times x 2 lists = 60 tokens
- Subjects are instructed to pronounce the target phrase in 'lazy speech' style.

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F₀ peak distribution of 4 tonal categories

Subject: VC

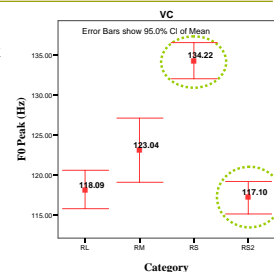


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Summary

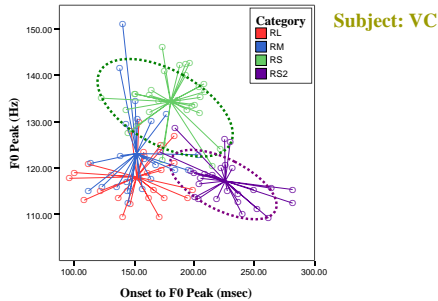
- [tək55]-derived 25 has a significantly higher F₀ peak than all other types.
- The mean F₀ peak of the [tsɔ25]-derived 25 syllables is significantly different from all other types except for the lexical 25 syllables'.



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All sandhi-derived 25 syllables are significantly longer than the other types.



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Summary & speculations

- Phonological representation must include fine grain phonetic details (Pierrehumbert 2003) in order to capture these subtle, yet systematic, phonetics differences in speech.
- The subphonemic tonal difference observed between the L-25 and S-25 can be captured representationally:
 - Lexical 25 = a unit (Yip 1989)
 - Sandhi-derived 25 = a sequence of MH level tones as predicted by a delinking and reassociation analysis of tone sandhi.

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The Evolution of the 'Changed Tone'

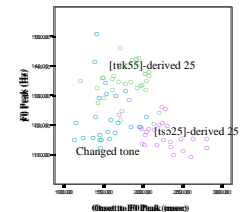
- In an exemplar-based model of phonology, the production of a label, say, a deverbal noun, involves making a selection from the exemplar cloud for that label.
- The intermediate status of the M-25 can be seen as a transition stage.

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The Evolution of the 'Changed Tone'

- 'Productively derived' changed tone syllables have two possible sources: [ʃi55] and [tsi25].
- When these two types of historical sandhi-derived 25 merged to form the changed tone category.
- The cloud of M-25 exemplars would include tokens of both sandhi-derived types.

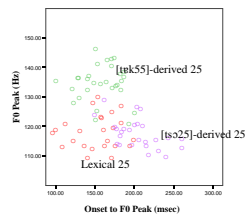


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The Evolution of the 'Changed Tone'

- Changed tone is a marginally productive, and socio-linguistically governed synchronic process (Whitaker 1956, Wong 1982).
- The lexicalized subset of the deverbal nouns are identified closely with the Lexical 25 exemplars.
- The others are 'productively derived' in the sense that they are identified with the S-25 exemplars.

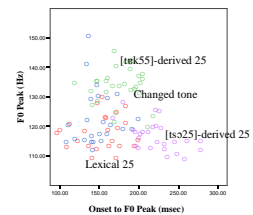


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The Evolution of the 'Changed Tone'

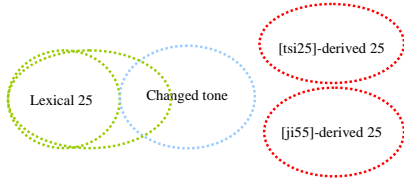
- The cloud of M-25 exemplars would include tokens of both the lexical and the sandhi-derived types.
- As the perceptual memories of the deverbal nominal forms accumulate and are incrementally updated, the distribution of M-derived forms shifts toward an F0 peak target closer to that of an L-25.
- Hence, the average F0 peak of an M-25 straddles that of the L-25 and the S-25.



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The Evolution of the 'Changed Tone'



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Sample quadruplets

RL	ɸəŋ25	'to untie'	
RM	ɸəŋ25	'heavy'	
RS	ɸəŋ25	'to be ready to be weighed'	
RS2	ɸəŋ25	'to have weighed'	

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The End

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