

Do first-language (L1) phonemic categories play a role in the perception of second-language (L2) phonemic contrasts?

A look from the perception of Cantonese codas by Mandarin speakers

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Abstract

In Mandarin and Cantonese, there are differences in the distribution of nasals and plosives in the coda position. This study investigated whether the phonological system of L1 or hierarchy of perceptual similarities has a larger effect on Mandarin speakers' perception of Cantonese phonemic contrasts. Our result suggests the later and the Perceptual Assimilation Model may need to take hierarchies of perceptual similarities into accounts when predicting L2 learners' discrimination ability in a second language.

Background

Distribution of codas in Cantonese and Mandarin

Cantonese				Mandarin			
	Bilabial	Alveolar	Velar		Bilabial	Alveolar	Velar
Nasal	m	n	ŋ	Nasal		n	ŋ
Oral	p	t	k	Oral			

1. Perceptual Assimilation Model (PAM) (Best, 1995)

- Based on comparison between native and non-native phonological systems.
- Two Category assimilation (TC):** 2 non-native phonemes are assimilated to 2 distinctive phonemes in L1. The discrimination between the two phonemes is expected to be very good.
- Single Category assimilation (SC) and Category Goodness difference (CG):** 2 non-native contrastive phonemes fall into the same L1 phoneme. The discrimination performance is expected to be poor.
- Uncategorized-Categorized pairs (UC):** one phoneme is categorized as a L1 category and the other one is categorized as a phonetic sound outside the L1 phonological system and hence cannot be assimilated to any L1 phoneme. The contrast is expected to be well discriminated
- Both Uncategorizable (UU type):** both non-native phonemes fall outside of the native phonological space. The predicted performance depends on the similarity of the non-native contrasts.

2. Hierarchy of perceptual similarities (HPS)

- English speakers rated the similarity of two syllables using a 6-point scale (1: most similar; 6: most dissimilar)
- Raw means of estimated perceptual similarities (Mohr & Wang, 1968)

	m	n	ŋ	p	t	k
m	-					
n	1.79	-				
ŋ	1.86	1.91	-			
p	3.71	4.39	4.70	-		
t	4.36	4.36	4.25	2.89	-	
k	4.79	4.67	4.01	3.08	2.95	-

Ohala (1990), Hura et al. (1992), and Winters (2001) removed all release bursts from the stop stimuli in their study through the use of stops in consonant clusters (i.e. /akpa/) and they found no significant differences in similarities between listeners' perception of nasals and stops with the same contrasts in places of articulation (i.e. /p/-t/ vs /m/-n/).

- Contrast in manner of articulation are perceived as more similar than contrast in place of articulation.

Research Question

Whether the phonological system of L1 or hierarchy of perceptual similarities has a larger effect on Mandarin speakers' perception of Cantonese phonemic contrasts. If the hierarchy of perceptual similarities plays a larger role than the phonological system of L1, then we will expect Mandarin speakers to have better discrimination performance for contrast in manner of articulation (e.g. /k/-ŋ/) than contrast in place of articulation (e.g. /n/-ŋ/) even though /k/ is not a phoneme in Mandarin but /n/ and /ŋ/ are phonemes in Mandarin.

Predictions based on PAM and HPS

	Contrast in place of articulation (oral)			Contrast in place of articulation (nasal)			Contrast in manner of articulation		
Contrast	/p/-t/	/p/-k/	/t/-k/	/m/-n/	/m/-ŋ/	/n/-ŋ/	/p/-m/	/t/-n/	/k/-ŋ/
PAM	Depends (UU)	Depends (UU)	Depends (UU)	Poor (SC/CG)	Good (UC/TC)	Good (TC)	Depends (UU)	Good (UC)	Good (UC)
HPS	Poor	Poor	Poor	Poor	Poor	Poor	Good	Good	Good

Methodology

Participants

- 20 native Mandarin speakers and 20 native Cantonese speakers
- All the Mandarin speakers have at least 8 months of exposure to Cantonese prior to the study.

Task

- Cross modal sound-character matching task (Traditional Chinese characters for Cantonese speakers and Simplified Chinese characters for Mandarin speakers)

Stimulus items

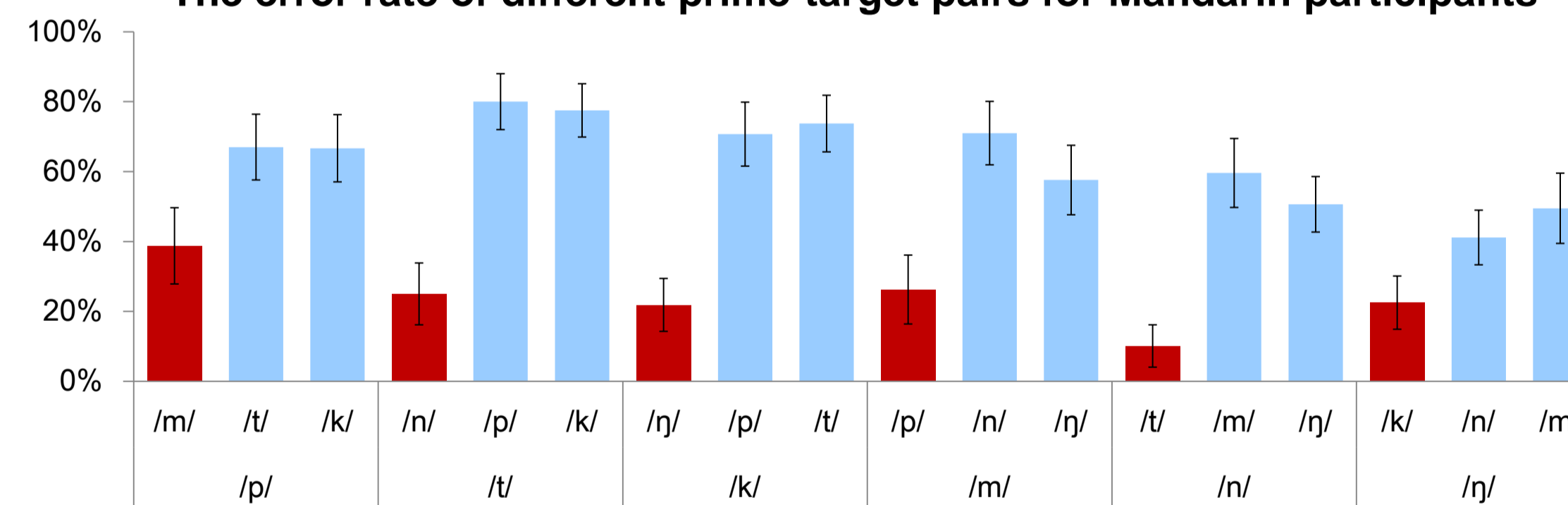
- 52 pairs of 'Mismatched' Cantonese syllables with minimal contrast in the coda position.
- There are 3 different conditions in the minimal pairs:
 - 16 pairs of oral codas with contrasts in the places of articulation (labial, coronal, dorsal) /p/-t/, /p/-k/ and /t/-k/ (e.g. /ts^hap³/ - 刷, /kap³/ - 格, /pet⁵/ - 北)
 - 18 pairs of nasal codas with contrasts in the places of articulation (labial, coronal, dorsal) /m/-n/, /m/-ŋ/ and /n/-ŋ/ (e.g. /sam⁵⁵/ - 山, /tsem⁵⁵/ - 增, /pen²¹/ - 貧)
 - 18 pairs of codas with contrast (same place of articulation) /p/-m/, /t/-n/ and /k/-ŋ/ (e.g. /t^hap³/ - 探, /set⁵/ - 新, /k^hok³/ - 抗)
- 52 pairs of 'Matched' items (e.g. /ts^hat³/ - 刷, /sam⁵⁵/ - 三, /t^hap³/ - 塔)
- 8 pairs of distractor items (with minimal contrast in onset or tone)
- All the items were recorded by the same Cantonese female speakers.

Analysis

- Only the error rates from the mismatched pairs were analyzed.

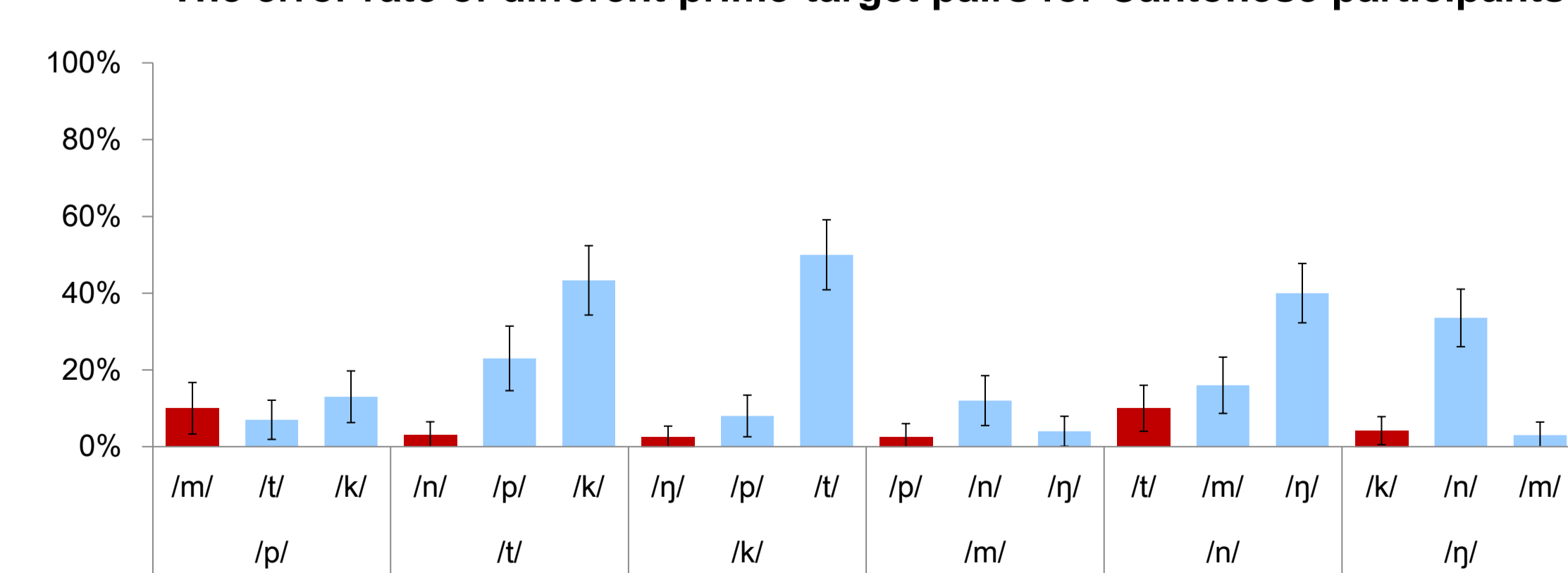
Results

The error rate of different prime-target pairs for Mandarin participants



Contrast in manner of articulation are perceived as less similar than contrast in place of articulation.

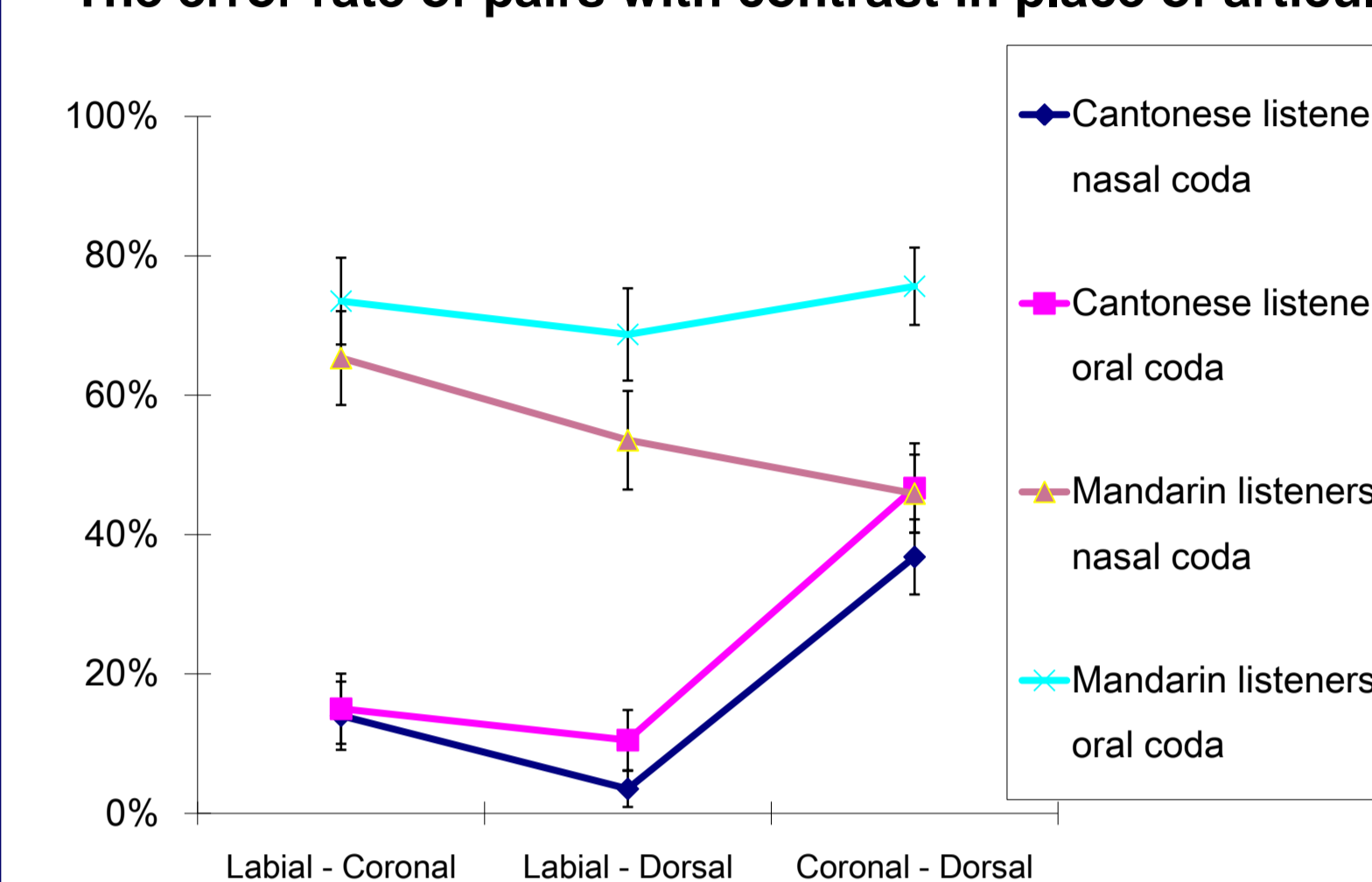
The error rate of different prime-target pairs for Cantonese participants



The discrimination performance is significantly poorer for coronal-dorsal contrast due to the ongoing sound merge in these 2 places of articulation (Zee, 1999).

Results

The error rate of pairs with contrast in place of articulation



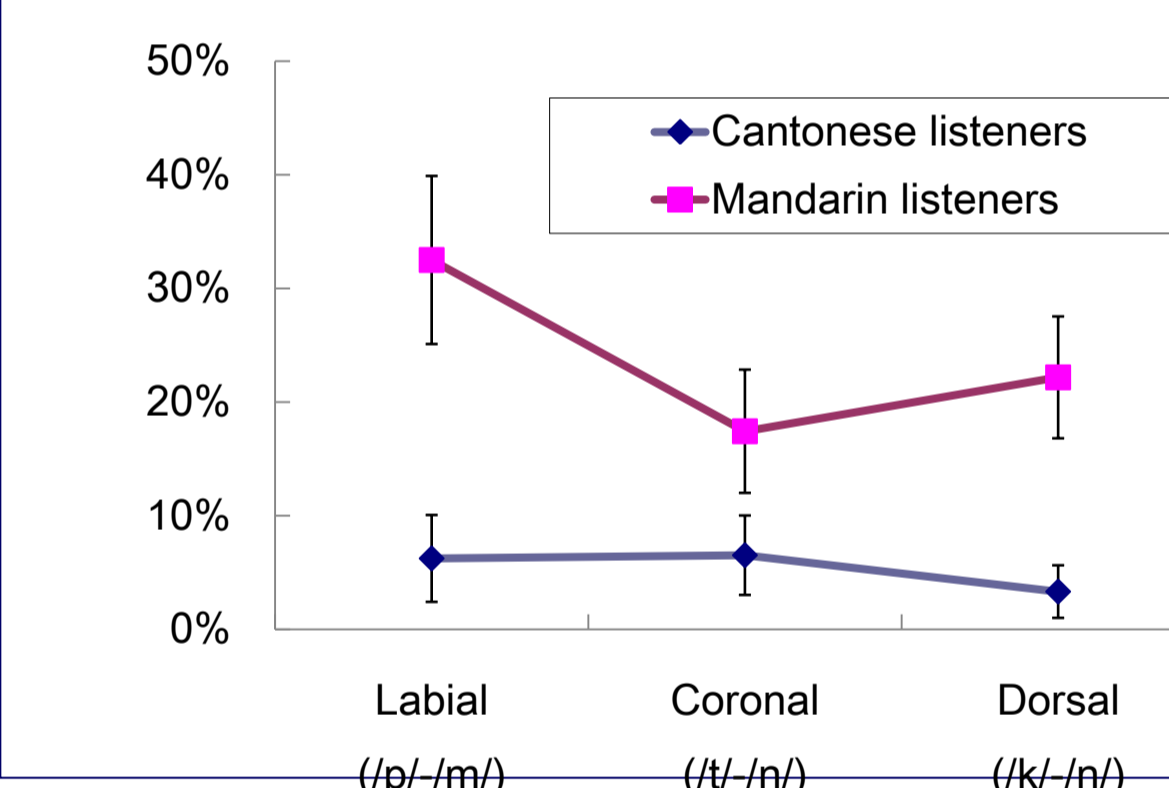
Mandarin speakers

There are no significant differences in perceptual similarities among the 3 place contrasts for oral codas. For nasal codas, labial-coronal (/m/-n/) contrast is perceived as the most similar, labial-dorsal (/m/-ŋ/) contrast the second and coronal-dorsal (/n/-ŋ/) contrast the least.

Cantonese speakers

The coronal-dorsal contrast is perceived as more similar than the labial-coronal and labial-dorsal contrast.

The error rate of pairs with contrast in manner of articulation



Mandarin speakers

Manner contrast in the labial position (/p/-m/) are perceived as more similar than those in the coronal (/t/-n/) or dorsal (/k/-ŋ/) position.

Cantonese speakers

There are no significant differences in perceptual similarities among the manner contrasts in the 3 place of articulation.

Discussion

- PAM
- Results showed that both universal hierarchy on perceptual distance and influence from native language would need to be considered to explore the competence of the phonological system of a second language speaker, but hierarchy of perceptual distance plays a relatively more important role in predicting the discrimination performance of difference contrasts by non-native speakers.
- However, as the results showed that Cantonese speakers also encountered difficulties in distinguishing coronal-dorsal contrast. An effect of input may also need to be considered when considering the relative importance of the phonological system of L1 and the hierarchy of perceptual distance.

Selected References

- Best, C.T. (1995). A direct realist view of cross-language speech perception. In Strange, W., editor, *Speech perception and linguistic experience: issues in cross-language research*. Timonium, MD: York Press, 171-204.
- Mohr, B. and W.S.-Y. Wang. (1968). Perceptual distance and the specification of phonological features. *Phonetica* 18, 31-45.