THE INFLUENCE OF THE L1 LEXICAL SYSTEM ON THE PROCESSING OF TONES IN L2

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ABSTRACT

Systematic correspondences can be found between Cantonese and Mandarin tones. For example, most of the words pronounced with tone 2 in Cantonese are pronounced with tone 3 in Mandarin (e.g., 找 'find'). Therefore, Cantonese speakers may mistakenly think that words where the Mandarin tone pronunciation does not follow the dominant pronunciation relationship (e.g., 摸 'touch', pronounced with Cantonese tone 2, but Mandarin tone 1) are pronounced in Mandarin with the dominant correspondence (i.e., tone 3). A Mandarin character-sound matching task using words which either employed a dominant (i.e., regular) or subdominant (i.e., irregular) tone relationship was carried out to examine whether the processing of Mandarin tones by Cantonese speakers was influenced by such relationships. The auditory stimulus either had a matched or a tone-mismatched pronunciation, where the mismatched pronunciations of irregular and regular words follow the dominant and subdominant tone relationships respectively. Results indicated that more mismatched pronunciations in irregular than regular Mandarin words were treated as the correct pronunciations for Cantonese speakers. The findings indicate that the processing of tones in an L2 is influenced by the L1 lexical system, not just the native phonological system.

Keywords: Cantonese, Mandarin, tone, first language, second language

1. INTRODUCTION

Cantonese and Mandarin are tone languages where a change in the pitch or contour of a syllable changes the meaning of a word [4]. Previous studies show that Cantonese speakers may, for example, confuse Mandarin tone 2 (rising) with Mandarin tone 3 (dipping) due to their acoustic similarity and the fact that Cantonese does not have a tone-category representing a dipping contour [5]. However, tone mispronunciations of Mandarin words by Cantonese speakers may also be due to transfer at the lexical level through morphemes that Cantonese shares with Mandarin. The existing tone pronunciation relationships between Cantonese and Mandarin are shown in Table 1. For example, 89% of the words pronounced with tone 2 in Cantonese are pronounced with tone 3 in Mandarin (e.g., 找 'find', pronounced *zaau2*[1] in Cantonese and *zhao3* in Mandarin). These will be referred to as "regular" words. There is evidence [6] that Cantonese speakers sometimes make errors by overgeneralizing the dominant correspondence to words that do not follow this relationship (i.e., "irregular" words). For example, 摸 'touch' is pronounced *mo1* in Mandarin, but even though the Cantonese pronunciation is *mo2*, Cantonese speakers sometimes think it is pronounced *mo3* in Mandarin. Such a mispronunciation cannot simply be explained in terms of negative transfer from the L1 phonological system, as these two Mandarin tones should be discriminated quite well by Cantonese speakers [5]. Instead, such errors imply

Table 1: Major tone correspondences between Cantonese and Mandarin words. [6]

Cantonese tones	Mandarin tones	Correspondence percentage	Examples	Cantonese pronunciation	Mandarin pronunciation
1 (high level)	1 (level)	93%	郊 'suburb'	*gaau**1***	*jiao**1***
2 (high rising)	3 (dipping)	89%	找 'find'	*zaau**2***	*zhao**3***
3 (mid level)	4 (falling)	92%	怪 'strange'	*gwai**3***	*gwai**4***
4 (low falling)	2 (rising)	93%	牛 'cow'	*ngau**4***	*niu**2***
5 (low rising)	3 (dipping)	75%	偉 'great'	*wai**5***	*wei**3***
6 (mid-low level)	4 (falling)	94%	又 'again'	*jau**6***	*you**4***

that the frequency of tone correspondences between the two languages has an impact on the pronunciation of irregular words.

An L2 Mandarin word production model has been proposed to explain how this might happen [1]. Cantonese speakers use two sources of information to produce L2 Mandarin words. A lexical route retrieves the stored Mandarin pronunciation of the word while a sublexical route generates the Mandarin pronunciation through Cantonese-Mandarin pronunciation relationships in accordance with the frequency with which those correspondences occur.

The use of such a sublexical route was supported in a task where Cantonese speakers gave Mandarin *pinyin* transcriptions of Chinese characters, and made more errors for words with a subordinate than a dominant correspondence in all sublexical units (i.e., onsets, rimes and tones) [3]. The use of a sublexical route was also evidenced in L2 Mandarin word recognition using a disyllabic word transcription task, as Cantonese speakers with low Mandarin phonological proficiency recognized disyllabic Mandarin words (e.g., 評估 'assess') which contained a character with a subordinate tone relationship (e.g., 估 'guess', pronounced *gu2* in Cantonese and *gu1* in Mandarin) better if it was mispronounced using the dominant relationship (*ping2gu3*) than the correct Mandarin pronunciation (*ping2gu1*) [2].

This new study serves to provide additional empirical support for the existence of the sublexical route in L2 Mandarin word production by Cantonese speakers. It uses a Mandarin character-sound matching task whereby the auditory stimulus has a tone that either matches or mismatches the pronunciation of the character, and that character has either a regular or irregular Mandarin tone. What is most important was the mismatched condition because it provides a window into the source of Mandarin tone processing. In the mismatch condition, the pronunciation of the auditory stimulus for an irregular character used the dominant tone correspondence, while that for a regular character used a subordinate tone correspondence. If the phonological representations of Mandarin words for Cantonese speakers were influenced by L1-L2 pronunciation relationships, it is expected that more irregular than regular Mandarin characters in the mismatched condition will be misclassified by Cantonese listeners as having a correct pronunciation.

In order to control for potential differences in the acoustic relationships within the tone pairs, native Mandarin listeners were included as a baseline for comparison with the Cantonese participants. For such participants, the regularity manipulation should be irrelevant since it involves the use of Cantonese. Although some of the Mandarin speakers had exposure to Cantonese and Cantonese-accented Mandarin, they would be unlikely to draw upon such knowledge in processing their native language.

2. METHOD

2.1. Participants

Thirty four native Cantonese speakers (aged 19 to 23 years, mean: 20.6 years) and 16 native Mandarin speakers (aged 18 to 24 years, mean: 19.9 years) from the Chinese University of Hong Kong participated in this study for a small payment. All the Cantonese speakers received formal education in Mandarin for at least three years. The Mandarin speakers had been residing in Hong Kong for an average of 1.47 years (ranging from 0.25 to 3 years). Their average self-rated exposure to Cantonese-accented Mandarin speech on a 10-point scale was 5.25, ranging from 3 (little exposure) to 10 (frequent exposure).

2.2. Materials

Seventy two visually presented characters were used. Half were regular and the other half was irregular Mandarin tone words for Cantonese speakers. Regularity was defined in terms of the dominance of the tone relationships between Cantonese and Mandarin. The regular and irregular words were matched on number of strokes and character frequencies. An auditory stimulus either matched or mismatched its corresponding character in terms of its tone. For irregular-tone words (e.g., 謊 'lie' *huang3*), the tone-mismatched pronunciation (e.g., *huang1*) was the pronunciation that Cantonese speakers would give if they were to apply the major tone corresponding rule. For regular-tone words (e.g., 郊 'suburb' *jiao1*), the tone of the mismatched pronunciation was the same as that of the correct pronunciation of the irregular word (e.g., *jiao3*). An additional 72 Chinese characters were chosen as distractors. The auditory stimulus for half of the distractors had a matched Mandarin pronunciation while the other

half had a completely different Mandarin pronunciation (i.e. mismatched in both segments and tones). The purpose of the distractors was to avoid participants focusing solely on the tones when making their judgments. All of the spoken stimuli were recorded by a native male Mandarin speaker on a Mac laptop computer in a soundproof room using Audacity software.

Two lists were created so that each participant saw each visual character and heard each auditory stimulus only once. The same character was followed by either the matched or the tone-mismatched pronunciation in the two lists. The items were presented in the same pseudo-randomized order for all participants. In accordance with standard usage, traditional Chinese characters were used for the Cantonese participants, and simplified characters for the Mandarin participants.

2.3. Procedure

Participants saw a Chinese character on the computer screen and then, after 400 ms, heard a Mandarin monosyllabic word spoken by a native Mandarin speaker. They were told to indicate quickly and as accurately as they can whether the monosyllables they heard matched the Mandarin pronunciation of the Chinese character they saw by pressing the corresponding buttons. All auditory items were presented through headphones via a laptop PC computer using DMDX software. There were twelve practice trials.

3. RESULTS

A mixed ANOVA analysis was carried out on the percentage of 'yes' responses with word type (regular vs. irregular) and auditory stimulus type (matched vs. mismatched) as within-group factors, and listener group (Cantonese vs. Mandarin) as a between-group factor. One irregular character (and its corresponding regular character) was removed from analysis since it was later discovered that it could be pronounced with either a matched or mismatched tone. The results for Cantonese and Mandarin listeners are shown in Table 2. The main effects of word type, auditory stimulus type and listener group were significant, as well as all two and three way interactions [*p*s < .001]. Planned comparisons were computed separately for each listener group.

For Mandarin listeners, the main effect of regularity was not significant [$F(1,14) = 2.84$, $p = .114$]. However, there was an effect of auditory stimulus type [$F(1,14) = 10395.49$, $p < .001$] and an interaction between regularity and auditory stimulus type [$F(1,14) = 7.70$, $p = .015$]. The interaction was caused by a higher percentage of 'yes' responses for irregular than regular words in the mismatched condition [$F(1,14) = 6.38$, $p = .024$], but not the matched condition [$F < 1$].

For Cantonese listeners, there was a significant main effect of regularity [$F(1,32) = 58.40$, $p < .001$], auditory stimulus type [$F(1,32) = 87.84$, $p < .001$] as well as an interaction between them [$F(1,32) = 175.99$, $p < .001$]. More 'yes' responses were observed in regular than irregular words in the matched condition [$F(1,32) = 62.19$, $p < .001$] while the opposite was true in the mismatched condition [$F(1,32) = 205.63$, $p < .001$]. More 'yes' responses were observed in the matched than mismatched condition for regular words [$F(1,32) = 358.70$, $p < .001$], but not for irregular words [$F < 1$].

A comparison of listener groups revealed no main effect of listener group for regular matched words [$F(1,46) = 2.62$, $p = .113$]. However, Cantonese listeners had a significantly lower percentage of 'yes' responses than Mandarin listeners in irregular matched words [$F(1,46) = 29.21$, $p < .001$]. More 'yes' responses were observed for Cantonese than Mandarin listeners in both the regular and irregular mismatched conditions [$F(1,46) = 11.18$, $p = .002$; $F(1,46) = 120.11$, $p < .001$, respectively], and the effect was larger in the latter than the former [$F(1,46) = 79.14$, $p < .001$].

Table 2: Percentage of 'yes' response for Cantonese and Mandarin listeners.

Auditory stimulus type	Mandarin listeners		Cantonese listeners	
	Regular-tone words	Irregular-tone words	Regular-tone words	Irregular tone words
Matched	98.9	98.5	97.0	73.6
Mismatched	2.1	5.6	21.1	70.0

4. GENERAL DISCUSSION

For Mandarin listeners, the non-significant difference in 'yes' responses for the matched pronunciations between regular and irregular words confirmed that there was no inherent difference between these two groups of words among native listeners. For Cantonese listeners, although a similar percentage of 'yes' responses as Mandarin listeners was observed for regular words, their percentage of 'yes' responses for irregular words was significantly lower than that for regular words. This suggests that the representation of Mandarin tones in irregular words for Cantonese listeners is different from Mandarin listeners. In accordance with the L2 Mandarin production model [1], this difference can be attributed to the use of a sublexical route through L1-L2 Cantonese-Mandarin tone correspondence when Cantonese speakers produce Mandarin words. Further support for this claim can be seen in the percentage of 'yes' responses in the mismatched condition among Mandarin and Cantonese listeners.

In the mismatched conditions, more erroneous (i.e., 'yes') responses were observed by Cantonese than Mandarin speakers. This indicates that the strength between the character and Mandarin phonological representations is weaker for Cantonese than Mandarin speakers. Of more importance is the fact that Cantonese speakers showed a larger regularity difference than the Mandarin baseline. This suggests that Cantonese speakers were using the sublexical route through L1-L2 tone relationships in generating L2 pronunciations as the mismatched pronunciations were those which employed the dominant pronunciation relationships.

The slightly higher 'yes' response for Mandarin speakers in irregular than regular tone words is somewhat surprising. Perhaps it arose from the exposure they had to Cantonese-accented Mandarin where they may have heard the dominant mispronunciation of irregular words.

To conclude, this study provides further evidence for the use of a sublexical route in L2 Mandarin production by Cantonese speakers. The tones of mismatched pronunciation for the words chosen in this study were never confusable with their correct tone pronunciation based on a comparison between the L1 and L2 sound system [5]. Therefore, our results cannot be explained by negative transfer from L1 at the phonetic or phonological level. Instead, it is the statistical relationships between L1 and L2 words at the lexical level that exert an influence on the way in which the phonology of L2 is processed, a level of abstraction that is not usually discussed in relation to L2 representations.

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