Comparing L1's Effects on English Coda Obstruent Perception: Korean and Chinese Identification Performance

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ABSTRACT

This study investigates the perceptual confusion of English obstruents in the coda position by Mandarin and Korean-speaking L2 learners. The two languages differ in that Mandarin does not allow obstruent codas, while Korean neutralizes underlying laryngeal and manner contrasts into voiceless stop codas. The stimuli are eight English obstruents /p b t d f v θ ð/ combined with the vowel /ɑ/. 41 Mandarin and 40 Korean speakers participated in an identification task. The results show that the Mandarin speakers generally achieved higher accuracy than the Koreans. The errors are further analysed based on their voicing, manner, and place confusions. Both groups exhibited a bias toward voiceless consonants, fricatives, and labial responses. The similarity of the two L1 groups suggests a strong and pervasive language-independent tendency in speech perception.

Keywords: Coda, L2 perception, Mandarin, Korean

1. INTRODUCTION

1.1. Orientation of linguistically-oriented models of second language acquisition

Many phonetically and linguistically oriented studies of a speaker's performance in a second language (L2) have been built around models of second language learning, such as the SLM [8, 11], or cross-language perception and learning, such as the PAM [1,2], and it is not an overstatement to say that these models dominate the research field in phonetic second language acquisition. One striking similarity between these two models is that they seek to determine how first language (L1) experience impacts the learning of an L2. The SLM maintains that the learnability of L2 sounds depends on their similarity to L1 categories. Likewise, the PAM was designed to generate hypotheses about the ease of distinguishing non-native contrasts based on the assimilation of these contrasts to the existing ones in the L1. In practice, then, most research in L2 phonological acquisition in these and similar frameworks focuses on aspects of the L1 as determining factors for the L2 performance. These studies share the assumption that if the learners speak L1s that differ in relation to the L2 phonological system, they will behave differently in learning the L2 sounds.

1.2. L2 acquisition of English coda consonants by speakers with different L1s

A number of studies examining the L1 effect on L2 sound acquisition targeted at the learning of English codas. It is because English allows a wide array of consonants in the coda position while most of its learners' L1's permit a more limited set. As a result, the L2 learners often have to acquire completely novel contrasts or familiar contrasts yet in a novel prosodic context. A debate arising from this research is whether having similar contrasts in the L1 is beneficial for the L2 learning. Some studies show that the learners rely on the perceptual cues for the voicing contrast in their L1 to distinguish the L2 contrast despite the fact that they occur in different prosodic positions. Specifically, while Chinese contrasts /t/ and /d/ only in the word-initial position, Chinese speakers from a variety of dialect backgrounds could identify the word-final /t/-/d/ contrast as accurately as native English speakers when a release burst is audible, which is the primary cue for the pre-vocalic voicing contrast in Chinese [9]. Similarly, whereas in Dutch a voicing contrast is only maintained in the onset position and neutralized in the coda, Broersma [3] has shown that Dutch speakers can perceive the English voicing distinction in the word-final position as well as that in the initial position, and their performance did not differ from native English speakers. These studies suggest that having similar contrasts in the L1 is not a necessary condition for the learners' success in acquiring the L2 contrasts in the coda position.

On the other hand, studies comparing different L1 groups yield divergent findings. Some reported that having coda consonants in the L1 that are similar to those in the L2 constitutes an advantage. For example, Flege & Wang [13] found that speakers of Cantonese, which has word-final /p,t,k/, perceived the English final voicing contrast more accurately than speakers of Mandarin, which does not allow any coda obstruents. In contrast, other studies found that the coda structure in the L1 has

little effect on the acquisition of L2 coda contrasts. For instance, Flege and colleagues [12] showed that Spanish and Mandarin speakers both deviated from the native norm in producing English /t/-/d/ contrast in the coda position, even though Spanish differs from Mandarin in allowing a limited range of coda stops. In another study, Flege [10] compared L1 speakers of Taiwanese and Mandarin, the former of which permits word-final /p,t,k/. It was found that both groups deviated from native English speakers in perceiving and producing the word-final /t/-/d/ contrast, showing no effect of the L1. These previous studies, then, do not exhibit unambiguous differences between language groups based on the status of codas in the L1.

1.3. Rationale for this study

One limitation of the previous studies is that they only examined the voicing contrast between one or two pairs of L2 sounds, raising questions concerning the generality of the results with respect to the various phonological structures in the languages in question. The main purpose of the current study is to investigate the perception of English consonants in two prosodic positions by speakers of Mandarin and Korean, with a focus on the coda position because these two languages differ crucially in their coda structure. More importantly, this study includes a wider variety of consonants, encompassing voicing, manner, and place contrasts. By having more consonants, we have an indication about the generality of effects of L1 across a larger portion of the phonological system. The main targets of analysis, then, are the patterns which arise across the consonant sets.

2. METHODS

2.1. Linguistic corpus

The stimuli are renditions of the 2-by-2-by-2 set of consonants contrasting in manner (stops & fricatives), voicing (voiceless & voiced), and place (labial & coronal): /p, b, t, d, f, v, θ, ð/. The consonants analyzed here appeared in monosyllabic non-words with the vowel /ɑ/, either in prevocalic position (onset) or post-vocalic position (coda).

With regard to the cross-language comparison, these consonants represent a range of similarity to consonants in Korean and Mandarin. The stops in the onset position map closely onto Korean counterparts, though Korean has an additional laryngeal contrast which divides the 'voiced' series in English [15, 21, 23]. Mandarin has voiceless aspirated and unaspirated stops in the onset position [5], which resembles closely the English laryngeal contrast since English /b,d,g/ are typically devoiced in word-initial position [18]. The non-sibilant fricatives do not occur in Korean, while Mandarin has /f/, but not the others.

Korean allows obstruents in the coda position, yet all the non-place phonemic contrasts are neutralized to plain unaspirated stops [16, 17], and Korean final consonants are not typically released [7]. Mandarin, by contrast, does not allow any obstruents in the coda position [5, 20].

2.2. Participants

40 native Korean speakers (12M, 28 F; age=24.97) participated in the experiment in Kyeonggi, Korea. And 41 native Mandarin speakers (22M, 19F; age=21.1) were run in Taipei, Taiwan. Both groups had received formal English instruction for 7-10 years, but none had lived in English-speaking countries for more than 3 months.

2.3. Stimuli

The stimuli were produced by 4 Midwestern American English speakers (2 male, 2 female), who were cued with orthographic prompts. The IPA symbols for the two dental fricatives were explained with key words at the beginning of the recording session. The 64 productions (8 consonants*2 prosodic positions*4 talkers) were spliced and randomized into one block with an inter-stimulus interval of 5 seconds.

2.4. Task

The participants listened to the 64 stimuli and identified the consonant in each stimulus using one of the 15 English labels provided. The English labels were introduced before the experiment, and marked with key words at the top of answer sheets. The choice of symbols was taken from previous mapping experiments [21].

3. RESULTS

3.1 Accuracy

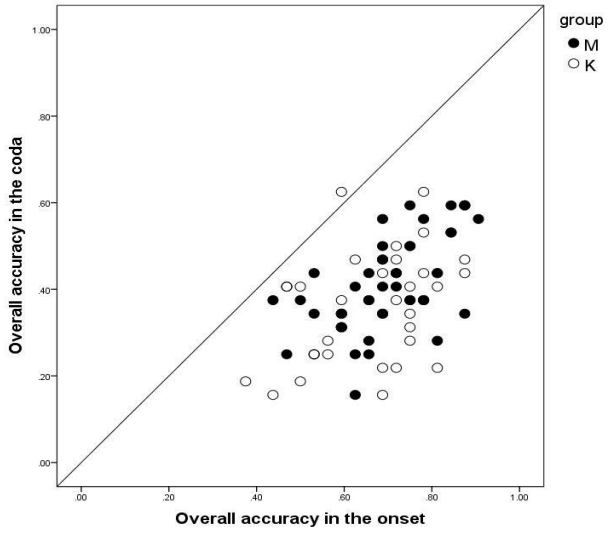
In order to insure that the overall identification abilities of the two groups are the same, we first compared their accuracy with consonants in the onset position. A logistic regression between listener groups and individual average consonant accuracies for onsets indicates non-significant differences across the groups ($r = 0.164$, $z = 1.71$, $p > 0.05$). This suggests that the Korean and Mandarin participants performed comparably

with onset consonants, and overall L2 perceptual proficiency was similar for the two groups.

The same analyses were run on the accuracy rates in the coda position. Yet different from the onset position, the Mandarin group performed more accurately than the Korean group (r = 0.360, z = 2.46, p < 0.05).

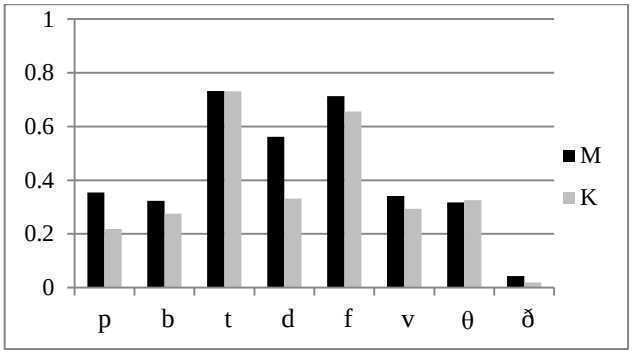
The overall coda accuracy is plotted against the onset accuracy for each participant in the two groups in Figure 1. Mandarin participants are labeled with filled circles and the Koreans with hollow circles. The solid and dashed lines represent the fit between the accuracy in the two positions for the Mandarin and Korean group respectively. A conspicuous commonality between the two groups is the majority of the data points falling below the x = y diagonal, indicating that the participants' accuracy in the coda position is, in all but one subject, lower than that in the onset. Deviations from onset to coda are sometimes as much as 60%.

Figure 1: Onset accuracy against coda accuracy for each participant in Mandarin and Korean L1 groups.



Looking more closely at specific consonants, the mean accuracies of the two groups are plotted in Figure 2. A most remarkable aspect of this figure is that the two groups had similar accuracy decrements cross consonants. E.g., both were most accurate with /t/ and /f/ and least accurate with /ð/. The only differences, identified by the logistic regression for accuracy in individual coda consonant are that the Mandarin group achieved significantly higher accuracy rates than the Korean group on /d/ (r = 0.324, z = 3.17, p < 0.01) and, marginally, /p/ (r = 0.194, z = 1.98, p < 0.05).

Figure 2: Group accuracy for every consonant in the coda position



3.2 Error patterns

To probe further the error patterns across the two groups, feature-level confusion matrices were compared. To do this, cases were grouped by voicing, by manner, and by place of articulation according to the target produced and the listeners' responses. For example, for the voicing analysis, a /b/→/v/ error would be categorized as a voiced response for a voiced target, while a /b/→/p/ error would be a voiceless response for a voiced target.

The two groups' confusion matrices for voicing are given in Table 1. Chi-squared comparison of the voicing confusion pattern between the two groups finds no significant difference ($\chi^2(3) = 3.79$, p = 0.29). Both groups made more errors on voiced target consonants. They frequently misidentified voiced targets as voiceless, and the opposite pattern is less often observed, pointing to a strong perceptual bias toward the voiceless consonants in the coda position.

Table 1: Erroneous responses classified according to the voicing dimension

		Response	
	Target	Voiced	Voiceless
Mandarin	Voiced	162	252
	Voiceless	84	204
Korean	Voiced	191	227
	Voiceless	80	206

Table 2 categorizes the two groups' erroneous responses based on the manner distinction. Chi-squared test reveals a significant difference in the response patterns between the two L1 groups ($\chi^2(3) = 22.11$, p < 0.01). The adjusted residuals between the observed and expected error counts indicate that the Mandarin group has fewer fricative→stop and more fricative→fricative responses than the Korean group. Also, the Mandarin group made slightly fewer stop→stop responses. Across the board, though, both groups misidentified stops as fricatives

more often than the other way around, suggesting a bias toward fricative consonants in the coda position.

Table 2: Erroneous responses classified according to the manner dimension

		Response	
	Target	Stop	Fricative
Mandarin	Stop	83	175
	Fricative	40	337
Korean	Stop	103	146
	Fricative	78	277

Table 3 gives responses categorized according to place of articulation. The two groups are not found to be significantly different ($\chi^2(3) = 2.83$, $p = 0.42$). Both groups generally made more errors on coronal targets than on labials, suggesting a bias toward the labial consonants.

Table 3: Erroneous responses classified according to the place dimension

		Response	
	Target	Labial	Coronal
Mandarin	Labial	192	104
	Coronal	208	141
Korean	Labial	172	106
	Coronal	169	144

5. DISCUSSION

The present study shows that learners' ability to identify English consonants clearly differs in the onset and coda positions. There was a very robust reduction in accuracy with codas with almost every subject in both L1 groups, contrary to previous studies which found no coda effects [3, 9]. This suggests that the acquisition of L2 sounds is context-sensitive, and the perceptual sensitivity to the L2 contrast in one position does not necessarily transfer to a different position.

The comparison of the two L1 groups' accuracy with English consonants does not support the proposition that having some coda stops in the L1 is more beneficial than having none in learning L2 codas [13]. While the two groups do not differ in their overall accuracy in the onset position, the decrement for the Korean group for coda consonants is larger than for the Mandarin group. Specifically, the Korean learners were less accurate than the Mandarin group on two stop consonants /d/ and /p/, which should map relatively well to the Korean coda categories. It thus seems that the experience with codas in the L1 may negatively interfere with L2 coda acquisition. Whereas the design of this study cannot tease apart whether the negative transfer results from the L1 coda inventory or the neutralization rules, the current findings clearly suggest that the prediction of L2 learning success cannot be solely based on the L2-L1 similarity.

When coda confusion patterns were examined, the two groups demonstrated great similarity despite the many differences in their L1s. Both groups were more biased toward labial responses. This is presumably due to the high error rates for the interdental fricatives, which have been found to be difficult for L2 learners with various L1s [24]. Furthermore, both groups showed a strong bias toward voiceless codas, which agrees with the former research that found prevalent 'coda devoicing' among L2 learners [4]. Finally, the two groups demonstrated clear tendency in identifying codas as fricatives as opposed to stops. Korean lexical borrowing tends to exhibit this pattern [14], but it seems uncommon in the context of previous acquisition studies. A tentative hypothesis could be that stop codas are more marked than fricatives according to the Sonority Sequencing Principle [6], and hence L2 learners may be more prone to a less marked syllable structure.

Overall, the most pervasive observation throughout the data is that both groups exhibited very similar response patterns. It is readily apparent that the L1 phonological structure is not the sole determining factor of learners' L2 identification performance. These results suggest that second language acquisition work needs to proceed in light of the observation that all listeners, regardless of L1, find some consonants more difficult to perceive than others, including native listeners. While native listeners are much more proficient at identification, this does not mean that all phonological structures have the same degree of difficulty. Many patterns found in studies of second language learners may not be due to the L1, but just be more extreme versions of patterns found in the native population. What this, in turn, suggests is that models of second language phonetic and phonological learning need to take seriously other components to the learning process than the L1 of the learner.

One final point to note is that this commonality between the different L1 groups is most obvious in the current study because the study probes a variety of consonants and thus gains a larger picture of the phonological system. Future work with a broader range of structures is surely called for.

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