PRODUCTION OF SCHWA BY JAPANESE SPEAKERS OF ENGLISH: A CROSS-LINGUISTIC STUDY OF COARTICULATORY STRATEGIES

Yuko Kondo
University of Edinburgh

ABSTRACT

The present study addresses the question of how L2 learners acquire the coarticulatory strategies of L2. English and Japanese manifest interesting contrasts in their coarticulatory patterns. The present study looks into the shift from the L1 to L2 coarticulatory pattern by observing the production of schwa by Japanese speakers of English.

INTRODUCTION

There are a number of interesting contrasts in the coarticulatory strategies of English and Japanese. Firstly, the reduced vowel, schwa, of English seems to be phonetically unspecified in F2 [2][3]. That is, the rhythm of English traditionally characterized as the alternation of full and reduced vowels may be described as the contrast of targeted and targetless vowels. In other words, different degrees of contextual assimilation are observed between full and reduced vowels of English. In Japanese, on the other hand, there is no unspecified vowel such as schwa and presumably all its vowels are targeted. Secondly, acoustic studies of V-to-V coarticulation have shown that English has stronger carryover than anticipatory effects in F2 [1] [5]. On the other hand, stronger anticipatory effects have been observed in Japanese [3] [4].

If Japanese speakers of English successfully shift their coarticulatory pattern from the L1 (Japanese) to the L2 (English) system, they would manifest a contrast in context dependent variability between schwa and full vowels. They would also show a shift in the relative strength from the R-to-L to L-to-R coarticulatory effects. As coarticulatory strategies are closely related to prosodic or organizational aspects of languages, a crosslinguistic study may yield an interesting insight into how speech is organized in these languages.

METHODS

Vb_bV sequences with the English schwa, the full vowel /æ/ and the Japanese vowel /a/ as the middle vowel were embedded in natural sentences. The contextual vowels were /ɪ/ and /æ/ or /ə/ for the English sequences and /i/ and /a/ for the Japanese sequences resulting in 12 different sequences in all as follows.

- *The campaign for Women's Lib abysmally failed.*

- *The inspector considered the lab abysmal.*

- *We found the crib abandoned in the car park.*

- *The crab abandoned its prey as it sensed something approaching.*

- *The fib Abbey National 's TV advert was said to contain turned out to be quite legal.*

- *When today's students were in the crib Abba were superstars.*

- *The robbers planned to grab Abbey National's armoured van.*

- *Nostalgia fans like to grab Abba records when they see them.*

- *Mukashi Babironia-to-iu kuni-ga arima'shita.*

- *So'to-dewa o'tsiba-bakari kasakasa-to oto'-o ta'te-te-imasu.*

- *Sei'sho-niwa Babironia-no-koto'-ga iroiro ka'ite-arimasu.*

- *Kawa'-niwa ka'ba-bakari-de-na'ku kiken-na wa'ni-mo imasu.*

Eight male British English speakers and five Japanese male speakers participated in the experiment. The native English speakers produced the 8 sequences with the English vowels while the Japanese speakers produced all the 12 sequences. Each sentence was repeated 5 times in a randomized order. In order to make the number of observations between native and non-native speakers more or less equal, the middle three repetitions were taken from each native speaker's production while all the 5 repetitions were used for the non-native speakers' production resulting in 24 observations per sentence type for native and 25 observations for non-native speakers respectively. The sentences were sampled at 16 kHz into a UNIX SUN workstation with WAVES speech analysis facilities. Formant values were obtained by running the FORMANT program for LPC analysis with a 25 ms cos**4 window moving in 5 ms steps. The measurements were taken at the onset, midpoint and offset of the vowel. Only the second formant values were studied as schwa was observed to be targetless in F2 [2][3].

RESULTS

Three-way ANOVAs were performed with the onset, midpoint and offset of the English vowels /ə/, /æ/ and the

Table 1. The results of ANOVA's for the English vowels /ə/ and /æ/ produced by British English and Japanese speakers and the Japanese vowel /a/ produced by Japanese speakers. The symbol + shows that the main effect of the preceding or the following vowel was significant by p < 0.01. The symbol – means that no significant effect was obtained.

speaker	vowel	preceding vowel onset	midpoint	offset	following vowel onset	midpoint	offset
English	ə	+	+	+	+	+	+
	æ	+	+	–	–	–	+
Japanese	ə	–	–	–	+	+	+
	æ	–	–	–	+	+	+
	a	+	+	+	+	+	+

Japanese vowel /a/ produced by English and Japanese speakers as dependent variables. The independent variables are preceding vowel, following vowel and speaker. Table 1 shows the results for the main effects. Significant interaction was observed between the preceding vowel and speaker at the onset of /ə/ for the native speakers' production. For the Japanese speakers' production, significant interactions were observed between the following vowel and speaker at the three points of the Japanese /a/ and the English /ə/ and at the midpoint and offset of the English /æ/. Where significant interactions were observed, speakers showed different degrees of V-to-V effects. One Japanese subject had higher mean F2 for schwa in the context of /æ/ than in that of /ɪ/ at all the three points of the segment.

A number of interesting observations may be made from Table 1. First of all, the reduced vowel /ə/ is more transparent than the full vowel /æ/ when they are produced by native speakers. That is, the effects of both the preceding and following vowel are observed right through the schwa whereas the effect of the preceding vowel is stopped at the midpoint of /æ/ and the effect of the following vowel is stopped at the offset. Secondly, the Japanese vowel /a/ is as transparent as the native speakers'/ə/. Thirdly, the Japanese subjects did not show any difference in sensitivity to context between the production of /ə/ and /æ/. Lastly, when the Japanese subjects produced the non-native vowels /ə/ and /æ/, their preference for anticipatory effects seems to be much more pronounced. Somehow their coarticulatory pattern is distorted and

different from either the L1 or the L2 pattern. There seems to be a strong over-projection of the preferred coarticulatory pattern of the L1 onto the interlanguage system.

Figures 1 and 2 show the differences in the mean F2 values as a function of the preceding and following vowel at the onset, midpoint and offset of the three vowels /ə/, /æ/ and /a/. When Figures 1 and 2 are compared, the native speakers' schwa shows stronger carryover than anticipatory V-to-V effects. Significant differences are observed right through the schwa for both carryover and anticipatory effects. For the full vowel /æ/, the differences are smaller for the carryove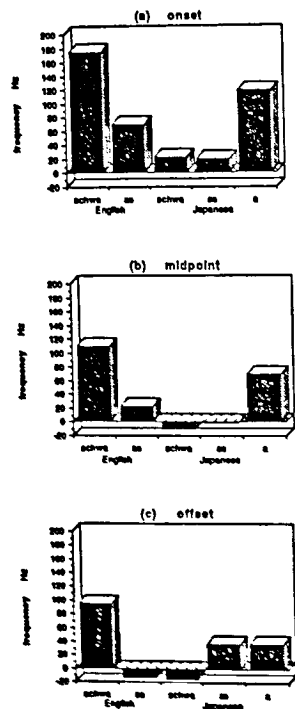r effects and the effects diminish around the midpoint of the segment. For anticipatory effects, the difference is observed only at the offset of the vowel.

For the Japanese vowel /a/, anticipatory effects are greater in magnitude compared to carryover effects. Significant differences are observed right through the segment for both carryover and anticipatory effects. The extent of V-to-V carryover effects observed on the Japanese /a/ is intermediate in degree between that observed for the English speakers' /ə/ and /æ/. However, for anticipatory effects, the Japanese vowel /a/ shows the greatest effects among the three. The Japanese speakers showed hardly any carryover effects for the English
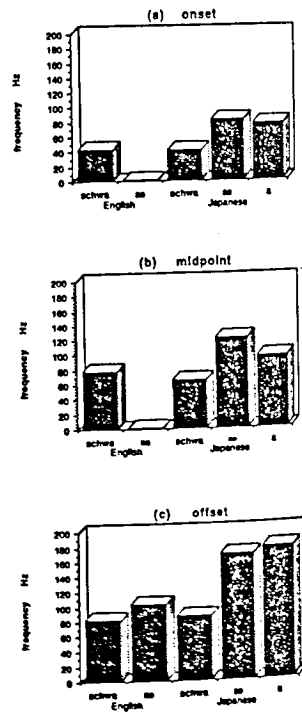

Figure 1. The differences in F2 values as a function of the preceding vowels /I/ or /i/ and /æ/ or /a/ for the English vowels /ə/ and /æ/ produced by English and Japanese speakers and the Japanese vowel /a/ produced by Japanese speakers.

Figure 2. The differences in F2 values as a function of the following vowels /I/ or /i/ and /æ/, /ə/ or /a/ for the English vowels /ə/ and /æ/ produced by English and Japanese speakers and the Japanese vowel /a/ produced by Japanese speakers.

/ə/ and /æ/. Also, unlike the native speakers' pattern, they showed stronger effects for the full vowel /æ/ than for schwa in anticipatory V-to-V coarticulation. These results seem to suggest that the Japanese speakers in the present study are not successfully shifting from the L1 to L2 coarticulatory strategies in speaking English. The general pattern seems to be that of a transfer, or more precisely an over-projection of their native coarticulatory pattern onto the interlanguage.

DISCUSSION

The context dependent variability of schwa in the indefinite article *a* is reported in [3]. In this study, VCəCV sequences with the consonantal contexts of /p, t, k/ and the vocalic contexts of /I, æ, u/ are embedded in natural sentences such as *You may pick a kitten from the basket.*. Two groups of non-native (Japanese) speakers of English produced these sequences. These groups may be described as fluent and non-fluent groups. In producing schwa, non-fluent speakers showed a coarticulatory pattern which may be described as a transfer from the Japanese vowel /a/ in F2 and non-systematic variability in F1. On the other hand, fluent speakers of English exhibited large and systematic variability in F2 which is very similar to the native speakers' pattern. These speakers seem to have acquired the phonetic underspecification of schwa in F2. Furthermore, two of the three fluent speakers of English showed stronger V-to-V carryover effects in the labial context where most native speakers of Japanese would show stronger anticipatory effects in Japanese. The results of the above study seem to contradict with the results of the present study. Different subjects used in the two studies may explain this contradiction. However, the subjects participated in the present study were relatively fluent speakers of English as well. Another possible explanation is the relative difficulty of the sentences used in the two experiments. The content words used in the present study, such as *abysmal*, *fib* and *crib* were not familiar to the Japanese subjects. This may have affected their performance. The L2-like

coarticulatory pattern reported in [3] may not immediately affect all the lexical items in the interlanguage. The L2-like coarticulatory pattern may gradually spread from more familiar words to less familiar words.

CONCLUSION

Contrary to the prediction, Japanese speakers of English showed less systematic contextual variability on /ə/ than on the full vowel /æ/. The pattern of V-to-V coarticulation across /b/ observed for the Japanese speakers' /ə/ and /æ/ may be characterized as a transfer or more adequately as an over-projection of the coarticulatory pattern of L1 onto the interlanguage. Their coarticulatory pattern of /ə/ was more deviant from the L1 pattern than that of /æ/. However, instead of approaching the L2 pattern they seem to have shifted away from the L2 as well. On the other hand, the coarticulatory pattern of /æ/ was more L1-like. This seems to suggest that the Japanese subjects in the present study had some awareness of schwa being a unique and different vowel, but somehow failed to produce the correct coarticulatory pattern.

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