Applied Psycholinguistics **22** (2001), 283–299
Printed in the United States of America

Effects of word class differences on L2 pronunciation accuracy

GRACE H. YENI-KOMSHIAN and MEDINA ROBBINS
University of Maryland, College Park

JAMES E. FLEGE
University of Alabama, Birmingham

ADDRESS FOR CORRESPONDENCE
Grace H. Yeni-Komshian, Department of Hearing and Speech Sciences, University of Maryland, College Park, MD 20742. E-mail: gyeni@hesp.umd.edu

ABSTRACT
This study examined the effect of word class (nouns vs. verbs) on L2 pronunciation accuracy of Korean–English bilinguals. The participants were 192 adult immigrants whose age of arrival (AOA) in the United States ranged from 6 to 23 years. Transcriptions of their productions of English sentences indicated that they were more accurate in pronouncing verbs than nouns. Similarly, the results of a grammaticality judgment test revealed that they were more accurate in detecting incorrect formulations of verbs than nouns. These effects were significant in late L2 learners (AOA 12–23). The results were interpreted to reflect the influence of the linguistic structure of Korean (where the verb is more prominent than the noun) on learning English as an L2.

A substantial number of studies have provided robust evidence for the effect of age of learning an L2 on pronunciation proficiency. These studies have shown that the L2 pronunciation of younger learners is consistently better than that of older learners (Asher & Garcia, 1969; Cochrane, 1980; Fathman, 1975; Flege & Fletcher, 1992; Flege, Munro, & MacKay, 1995; Flege, Yeni-Komshian, & Liu, 1999; Oyama, 1979; Patkowski, 1990; Suter, 1976; Tahta, Wood, & Loewenthal, 1981; Thompson, 1991; Yeni-Komshian, Flege, & Liu, 2000; see also reviews in Birdsong, 1999; Long, 1990). Usually such studies are carried out with immigrants to an English-speaking country; the immigrants' age of arrival (AOA) in the host country is used as an index of the age at which they first began to learn English.

When asked to make perceptual judgments of overall L2 pronunciation proficiency, listeners tend to respond with apparent ease, yet the exact components of pronunciation and their relative weights in contributing to pronunciation judgments are not as easy to determine. Some components of pronunciation, such as the production of vowels and consonants, have been studied fairly extensively (for reviews and discussions, see Flege, 1995, 1999). In this study, we focus on a previously unstudied variable that we believe could influence pronunciation

© 2001 Cambridge University Press 0142-7164/01 $9.50

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

proficiency in the L2. Specifically, we examine the role of word class (nouns vs. verbs) on pronunciation accuracy in bilinguals who began learning their L2 between the ages of 6 and 23. In addition, we analyze word class effects in grammatical judgments to determine whether differences in pronunciation are reflected in the processing of certain grammatical structures.

Word class effects in adults

Word class differences have been shown to have an effect on the word retrieval abilities of adult aphasic patients. Studies on function versus content word processing (Friederici, 1983, 1985; Swinney, Zurif, & Cutler, 1980) have suggested that this type of word class distinction influences language processing in patients with aphasia as well as unimpaired adults. Our primary concern in this study is with the word class distinction between nouns and verbs. The results of several studies have shown that patients with anomic aphasia were better at naming verbs than nouns (Miceli, Silveri, Villa, & Caramazza, 1984; Zingeser & Berndt, 1988). However, Miceli et al. (1984) and McCarthy and Warrington (1985) found that patients with agrammatic aphasia performed better at naming objects than actions. Both Zingeser and Berndt (1988) and Miceli et al. (1984) stated that their findings provided evidence that the lexicon is organized along word class categories, and that verbs constitute a distinct category from nouns. The findings of a later study (Caramazza & Hillis, 1991) support their conclusions. These studies provide evidence that word class (i.e., separate categories for nouns and verbs) is one dimension along which the lexicon is organized, and that different processing mechanisms underlie these categories.

Word class effects in L1 acquisition

Most developmental studies on the acquisition of vocabulary have concentrated on the distinction between nouns and verbs. The majority of these studies have shown that, in the course of L1 acquisition, children tend to acquire nouns faster than verbs (Gentner, 1978; Nelson, 1973, 1988). In a cross-language study, Gentner (1982) examined the early vocabularies of 16 children from six language communities (Chinese, German, English, Japanese, Kaluli, and Turkish); she found that, in all cases, the proportion of nominals was larger than that of predicate terms in the vocabularies of the children. Since these languages differ vastly in linguistic structure, Gentner concluded that the noun bias in children's early vocabulary is universal. According to her, conceptual – not linguistic – factors account for the difference in acquisition rate. She hypothesized that the category of nouns is conceptually simpler than that of verbs (nouns are more concrete, more tangible, and higher in imagery than verbs) and suggested that this distinction accounts for the higher number of nouns than verbs in early child language.

Although Gentner's (1982) claim for the universality of a noun bias in children's early vocabulary has been accepted by some researchers, others have challenged this claim (Choi, 1998; Tardif, 1996). These authors focused on the relationship between the characteristics of parental speech and the vocabularies of children. They investigated whether variations in maternal input would be

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

reflected in children's vocabularies. Some argued that in English-speaking environments nouns are more prominent than verbs in parental speech, in that nouns occur more often than verbs in the salient utterance-final position, and that this finding explains the noun bias in the vocabularies of English-speaking children. To test whether this interpretation is true, Gopnik and Choi (1990, 1995), Gopnik and Meltzoff (1993), Au, Dapretto, and Song (1994), and Choi and Gopnik (1995) examined Korean, a language whose basic word order is subject–object–verb. These studies showed that, when Korean mothers spoke with their children, they highlighted verbs more than nouns, and that verbs appeared in the salient utterance-final position more often than nouns.

However, the results based on early child vocabulary are not consistent across these studies. Au et al. (1994) reported that, regardless of the language spoken by the caretaker, all children produce more nouns than verbs. This finding supports the universal noun bias position (Gentner, 1982), which is also supported by findings from artificial vocabulary learning experiments conducted with children (Camarata & Leonard, 1986; Camarata & Schwartz, 1985). But evidence from studies by Choi and Gopnik (1995) and Gopnik and Choi (1995) present a different picture. These authors found that the differences in child-directed speech between Korean- and English-speaking mothers did have an influence, in that Korean children acquired verbs earlier than English children did. Along similar lines, a study by Tardif (1996) found that Mandarin Chinese-speaking children had more verbs than nouns in their productive vocabularies. These findings cast doubt on the assertion of a universal noun bias in children's early vocabulary.

Although the controversy regarding the nature of word class distinctions and their organization in the lexicon continues, the studies reviewed here show that lexical processing in adults and L1 vocabulary acquisition in children are affected by word class distinctions. The question is whether there are word class effects in L2 learning. In the present study, we wanted to find out whether word class would have an effect on the pronunciation accuracy of phonetic segments in non-native speakers of English. This is an unusual question because it is generally assumed that pronunciation accuracy is affected by the type of phoneme produced and not by word class differences. Should pronunciation accuracy vary as a function of word class, this would provide phonologically based support for the organization of the lexicon according to categories based on word class distinctions. It would also provide empirical support for the link between the lexicon and pronunciation.

METHOD

Participants

The participants were 192 Korean–English bilinguals who had emigrated from Korea to the United States. Their age of arrival (AOA) in the United States was between 6 and 23 years. These participants, along with 48 very early L2 learners (AOA 1–5), were part of a larger project which involved the participants in a series of tasks, including speech production tests in their L1 and L2 and a

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

Table 1. *Group descriptions, labels, English and Korean pronunciation ratings (*z *scores)*

Description	Group label	English pronunciation	Korean pronunciation
AOA 6–7	KB 7	.864 (.47)	−1.093 (.67)
AOA 8–9	KB 9	.571 (.54)	.047 (.68)
AOA 10–11	KB 11	.179 (.60)	.323 (.57)
AOA 12–13	KB 13	−.196 (.65)	.631 (.47)
AOA 14–15	KB 15	−.770 (.53)	.685 (.48)
AOA 16–17	KB 17	−.778 (.57)	.576 (.50)
AOA 18–19	KB 19	−.997 (.54)	.767 (.43)
AOA 20–23	KB 21	−1.201 (.53)	.640 (.45)

Note: Listeners judged productions of sentences S-1, S-2, S-5, S-8, and S-14 (see Appendix 1) for the English pronunciation ratings.

grammaticality judgment test in their L2. The very early L2 learners were not included in the present study because they did not produce segmental errors in pronunciation. Several aspects of the performance of the larger group of Korean–English bilingual participants have been analyzed, and the results have been reported in two publications (Flege et al., 1999; Yeni-Komshian et al., 2000).

The 192 participants in this study were divided into eight groups of 24, based on AOA. There was an equal number of males and females in each group. The chronological age of the participants at the time of testing ranged from 18 to 47 years ($M = 27$ years). All participants had normal hearing, most were students enrolled at area universities, and all had resided in the United States for a minimum of 8 years ($M = 13$ years) prior to testing. Additional information about the participants' language background, academic experience and achievement in Korea and the United States, use of L1 and L2, and motivation to learn two languages can be found in Flege et al. (1999) and Yeni-Komshian et al. (2000).

Table 1 contains information about the eight groups of participants: the AOA range in each group; the average AOA, rounded to the nearest whole number, for the Korean bilingual (KB) groups; and the participants' pronunciation proficiency in their two languages. The measures of pronunciation proficiency are taken from the pronunciation ratings carried out in the larger study (Yeni-Komshian et al., 2000). Ten monolingual English listeners rated the pronunciation of five English sentences by the participants. The pronunciation of five Korean sentences produced by the same participants was rated by ten monolingual Korean listeners. The listeners faced a computer screen with a 9-point scale displayed on it. They were asked to listen to one sentence at a time and to select a number on the rating scale that best reflected their judgment of how each sentence was pronounced. The endpoints of the English rating scale were (9) "no accent" and (1) "very strong accent"; the endpoints of the Korean scale were (9) "very good pronunciation" and (1) "very poor pronunciation." Each

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

speaker's pronunciation was rated a total of 150 times per language (10 Listeners × 5 Sentences × 3 Repetitions). To compare the participants' pronunciation in English and Korean, the overall average ratings per language were transformed to *z* scores. The calculation of *z* scores was based on the distribution of rating scores in the larger sample ($N = 240$). Positive numbers indicate above-average ratings and negative numbers reflect below-average ratings. For additional details regarding the selection of sentences and the participants and listeners' ratings, see Yeni-Komshian et al. (2000).

The results of the pronunciation scores (see Table 1) indicate that KB7 to KB9 (AOA 6–9) were significantly better in English than Korean pronunciation, KB13 to KB21 (AOA 12–23) were significantly better in Korean than English pronunciation, and for KB11 (AOA 10–11) English and Korean pronunciation scores were not significantly different from each other. Overall, the participants in KB13 to KB21 (AOA 12–23) were native-like in Korean (L1) pronunciation; their pronunciation in English was accented, and heavier accents were noted with increasing AOA. The participants in KB13 to KB21 were classified as late L2 learners and, judging from their pronunciation scores in English and Korean, were considered to be dominant in Korean.

Procedure

The participants were tested individually by Korean–English bilinguals in a quiet room. The English sentences test consisted of 24 sentences, which were recorded by an adult male native speaker of American English and presented through a loudspeaker. The participants were provided with a sheet listing the sentences while they listened to the audiotaped model. A delayed repetition procedure was used to elicit the sentences. Each sentence was elicited twice in succession: the first time after a short (1.2 s) delay, and the second time after a longer (4.0 s) delay. The first three sentences were presented again at the end of the test and therefore were not included in the analysis. The present study examines the pronunciation of 21 English sentences by each participant after the longer delay. These sentences are listed in Appendix 1. The English pronunciation ratings shown in Table 1 are based on sentences S-1, S-2, S-5, S-8, and S-14 in Appendix 1.

Transcriptions

Information concerning mispronounced phonetic segments was gathered from transcriptions of the English sentences produced by each participant. Four native speakers of American English, all graduate students in speech–language pathology and trained in phonetics, transcribed the sentences.

Each transcriber was provided with sheets that listed the 21 sentences. They were instructed to mark on each sentence the phonetic segments that they perceived were produced differently from native American English pronunciation. They worked independently at their own pace and were encouraged to replay the tape to check their accuracy. In most instances they were able to write, in broad IPA transcription, whatever the speaker had said that deviated from native

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

pronunciation. In a few instances, the segment was not acceptable because of an inappropriate shortening or lengthening of vowels and consonants or a dentalization of alveolar consonants. These instances were also marked as deviations from native pronunciation. All deviations were classified as errors of pronunciation.

The 21 sentences contained 168 words (67 function words and 101 content words). To simplify matters, we focused on the pronunciation of the initial consonant and following vowel of the words for the reliability analysis. The analyses dealing with word class effects were carried out with matched lists of content words selected from the sentences. In Appendix 1, the words selected from each sentence are shown in brackets.

Reliability

Various approaches for establishing reliability were reviewed; the method deemed most appropriate for the level of precision of our transcriptions was to examine whether the initial consonant and the following vowel of each word were marked as correct (acceptable native pronunciation) or in error (deviating from native pronunciation) by the two transcribers. For two words that began with a consonant cluster (*tried, play*), the initial consonant was used in the reliability analysis. For nine words that began with a vowel (seven function words: *obey, used*), the vowel was used in the vowel analysis. Accordingly, the 168 words in the two sets of transcriptions for each of the 192 participants were compared, word-by-word, and a record was made to indicate whether the transcribers agreed in their markings of the consonant and vowel segments.

The level of agreement between the two transcribers for each of the eight AOA groups was 90% or better. For initial consonant segments, agreement across the eight AOA groups ranged from 92% to 98%, and for following vowel segments, agreement ranged from 90% to 100%. The transcription of one member in the pair of transcribers was selected randomly for additional analysis.

Selection of word lists

Although initial analyses using all the nouns and all the verbs revealed word class differences in pronunciation accuracy, it was important to eliminate – or at least reduce – confounding effects due to phonetic content or frequency of usage. Our aim was to create lists of words for noun/verb comparisons that were equated for the phonetic content of the initial consonant and the following vowel as well as for the frequency of occurrence in English (Francis & Kucera, 1982). To achieve this goal, it was necessary to prepare two sets of noun/verb word lists. In the first set, the phonetic content of the initial consonant was equated by matching a noun with a verb that began with the same initial consonant. These words were used for the initial consonant pronunciation analysis (the initial consonant of one word, *tried,* was used in the analysis). In the second set, we selected noun/verb pairs that had the same vowel following the initial consonant. These words were used in the following vowel pronunciation analysis. In choosing pairs of words for matching phonetic content, the frequency of

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

usage counts were also used to select pairs of words that were close in frequency (Francis & Kucera, 1982). We selected 20 noun/verb pairs that were matched for initial consonant and 20 noun/verb pairs that were matched for following vowel. In all, 56 out of 101 content words were selected to create the two word lists. Some words (26/56) were used in both lists; the remaining words (29/56) appeared in only one list. See Appendix 2 for the two sets of word lists.

The word frequency counts for the 20 nouns and 20 verbs in each word list were compared by means of *t* tests, which indicated that the frequency counts in the noun list and verb list were not significantly different from each other: $t(19) = 1.61$, $p < .12$, for the initial consonant word list; $t(19) = 1.10$, $p < .28$, for the following vowel word list.

One potential confounding variable is the location of the selected words in the sentence. An examination of Appendix 1 shows that the selected nouns and verbs (i.e., the words listed in brackets at the end of each sentence) appeared equally often in a variety of positions. That is, it was not the case that the verbs were consistently in the middle of the sentences and the nouns were at the beginning and the end of the sentences. The average length of the sentences was eight words; the average position in the sentence of the selected nouns and verbs was the fifth word and the fourth word, respectively.

RESULTS

Pronunciation accuracy

An analysis of errors in pronouncing consonant and vowel segments of the selected words was carried out using two-way ANOVAs, with KB group (eight levels) as a between-subjects variable and word class category (two levels) as the within-subject variable. Post-hoc multiple group comparisons were carried out using the Newman–Keuls test ($p < .05$), and significant interactions were analyzed using simple main effects analysis. The percentage of initial consonant and following vowel errors in producing the words in each word class category for each participant was used in these analyses. Overall, the participants produced fewer consonant errors (2.4%, $SD = 4.4$) than vowel errors (6.0%, $SD = 7.6$). As might be expected, the early L2 learners (AOA 6–11) made fewer pronunciation errors than the late L2 learners (AOA 12–23) did. The correlations between AOA and total consonant errors ($r(190) = .31$, $p < .0001$) and total vowel errors ($r(190) = .69$, $p < .0001$) were significant, indicating more pronunciation errors with increasing AOA. The correlations between consonant errors in nouns and verbs ($r(190) = .52$, $p < .0001$) and vowel errors in nouns and verbs ($r(190) = .53$, $p < .0001$) were also significant.

All errors in the pronunciation of initial consonant and following vowel segments were substitutions. Overall, certain consonants (e.g., θ, r, p) and vowels (ɪ, i, ʊ) were more likely to be mispronounced than other consonants (e.g., f, t) and vowels (e, o, ə). This pattern of pronunciation errors was equally true for nouns and verbs, as could be expected from the significant correlation presented here. The typical substitutions for θ was either an unacceptable θ (dentalized and too long) or a [d]. Intended [r] was mispronounced as [l], and intended [p]

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

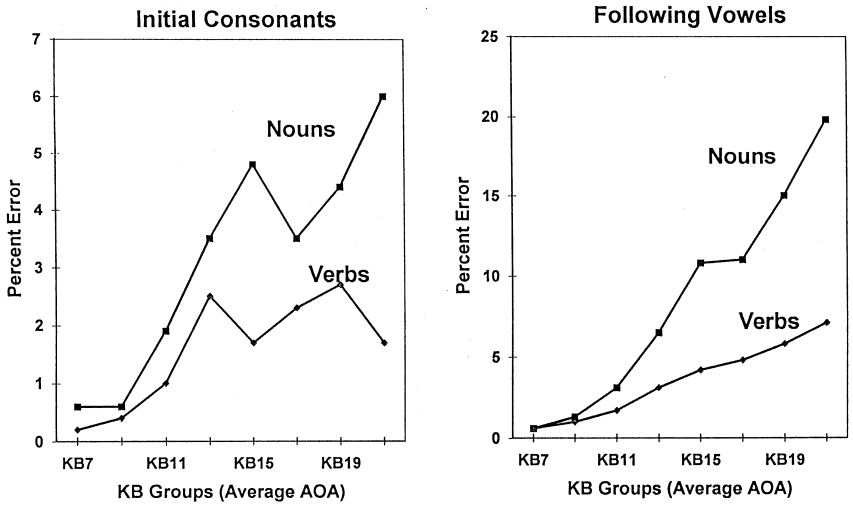


Figure 1. Mean percentage of errors in pronouncing nouns and verbs in the eight KB groups: (left panel) initial consonant errors, (right panel) following vowel errors.

was mispronounced as [f]. The most common substitution for [ɪ] was [i]; for [i], [ɪ]; and for [ʊ], [u]. These types of substitutions were present, in comparable proportions, in both noun and verb productions.

Initial consonants. The percentage of initial consonant errors in pronouncing the 20 nouns and 20 verbs is displayed in the left panel of Figure 1. The analysis revealed a significant main effect for group, $F(7, 184) = 3.62$, $p < .001$; multiple group comparisons indicated that speakers in KB7 to KB9 (AOA 6–9) produced significantly fewer errors than those in KB21 (AOA 20–23). The remaining KB groups had intermediate levels of pronunciation errors. The main effect for word class was significant, $F(1, 184) = 25.20$, $p < .0001$, indicating that more consonant errors were produced in nouns than verbs. In addition, there was a significant group by word class interaction, $F(7, 184) = 2.48$, $p < .02$. Tests for simple main effects showed that higher accuracy in pronouncing verbs than nouns was significant only for speakers in KB15 (AOA 14–15) and KB21 (AOA 20–23).

Following vowels. The percentage of following vowel errors in pronouncing the 20 nouns and 20 verbs is shown in the right panel of Figure 1. The ANOVA revealed a significant main effect for group, $F(7, 184) = 26.54$, $p < .0001$; multiple group comparisons showed that the early L2 learners (KB7: AOA 6–7) produced significantly fewer errors than the late L2 learners (KB13 to KB21: AOA 12–23). The effect of word class was highly significant, $F(1, 184) = 111.92$, $p < .0001$, indicating that more vowel errors were made in the production of nouns than verbs. The analysis also revealed a significant interaction

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

between group and word class, $F(7, 184) = 11.67$, $p < .0001$. Tests for simple main effects indicated that higher accuracy in pronouncing verbs than nouns was significant in KB13 to KB21 (AOA 12–23). For KB7 to KB11 (AOA 6–11), the difference in accuracy between noun and verb pronunciation was not significant.

Grammaticality judgments

The results presented so far indicate that Korean–English bilinguals made more errors in pronouncing nouns than verbs, and that these word class effects were mediated by AOA. The effect was stronger in participants whose AOA was between 12 and 22 years than in participants in the younger AOA groups.

The participants' performance on a sentence reception task was evaluated to determine whether the pattern observed for pronunciation (i.e., better performance on verbs than nouns) would also be evident in a grammaticality judgment test in which nouns and verbs were featured. The test, which contained 144 sentences, targeted nine types of English sentence structures. A detailed account of the results based on the entire test can be found in Flege et al. (1999). For the present study, we looked at the participants' performance in judging the grammaticality of sentences designed to assess plural (noun) and third person singular (verb) morphemes. We made this choice over other alternatives (e.g., past tense) because these two grammatical morphemes have identical phonetic realizations in their regular expression. Each grammatical morpheme was tested with 16 sentences (8 grammatical and 8 ungrammatical). As can be seen in Appendix 3, the ungrammatical sentences were created by omitting the required morpheme, replacing the required morpheme with an inappropriate morpheme, adding the plural morpheme to mass nouns, or regularizing an irregular item. The 32 sentences selected for analysis in the present study were drawn from Johnson and Newport (1989).

Figure 2 displays the average number of errors made by the eight KB groups in judging grammatical and ungrammatical sentences. It can be seen that, across all KB groups, very few errors were made in judging the grammatical sentences. However, errors were made in judging the ungrammatical sentences; the level of error was elevated for the late L2 learners. As shown in Figure 2, the participants made more errors in judging plural sentences than third person singular sentences. The correlations between AOA and number of errors on plural sentences ($r(190) = .44$, $p < .0001$) and third person singular sentences ($r(190) = .31$, $p < .0001$) were significant. Furthermore, the correlations between performance on plural sentences and consonant pronunciation in nouns ($r(190) = .24$, $p < .0001$) and vowel pronunciation in nouns ($r(190) = .38$, $p < .0001$) were significant. Similarly, performance on third person singular sentences and consonant pronunciation in verbs ($r(190) = .25$, $p < .0001$) and vowel pronunciation in verbs ($r(190) = .24$, $p < .0001$) were significant. Once again, we see that, with increasing AOA, the participants had more problems with grammaticality judgments and pronunciation.

A three-way ANOVA, with group (eight levels), morpheme (two levels), and grammaticality (two levels) as factors, was used to analyze the error scores. All

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

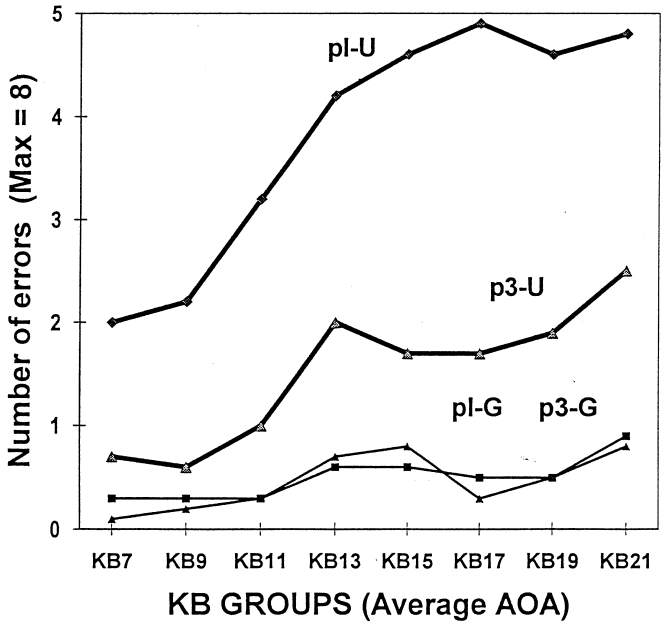


Figure 2. Mean number of errors made in judging the grammaticality of sentences: plural (pl) and third person singular (p3) in grammatical (G) and ungrammatical (U) sentences.

main effects were significant: group, $F(7, 184) = 10.86$, $p < .0001$; morpheme, $F(1, 184) = 200.11$, $p < .0001$; and grammaticality, $F(1, 184) = 323.11$, $p < .0001$. In addition, there were significant interactions between group and grammaticality, $F(7, 184) = 4.17$, $p < .0003$, and between morpheme and grammaticality, $F(1, 184) = 205.02$, $p < .001$, but the interaction between group and morpheme was not significant. The triple interaction was also significant, $F(7, 184) = 2.47$, $p < .02$.

A separate two-way ANOVA (group by morpheme) was carried out using the responses to the ungrammatical sentences to examine the significant interactions obtained in the three-way ANOVA. This analysis revealed a significant main effect for group, $F(7, 184) = 7.99$, $p < .0001$, and morpheme, $F(1, 184) = 247.98$, $p < .0001$. The significant group by morpheme interaction, $F(7, 184) = 2.395$, $p < .02$, was evaluated by a simple main effects analysis. This analysis revealed that participants in all KB groups produced significantly more errors on plural sentences than third person singular sentences, but, as can be seen in Figure 2, this effect was much stronger for KB15 to KB21 (AOA 14–23). The findings of this analysis revealed a strong and consistent pattern: the participants made more errors in detecting incorrect expressions of the plural than the third person singular, and this effect became stronger with increasing AOA.

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

DISCUSSION

The major finding of this study was that, when non-native speakers of English produced English sentences, their pronunciation abilities were affected by the word class to which a target word belonged. The participants produced a higher percentage of initial consonant and following vowel errors in pronouncing nouns than verbs. Their tendency for higher accuracy in pronouncing the same set of phonemes in verbs than nouns was accompanied by the fact that they were more likely to detect grammatical errors when the error was in a verb construction (third person singular) than a noun construction (plural). The results also indicate that word class effects were mediated by the speakers' AOA, revealing more errors and larger differences in pronunciation and grammatical judgments between nouns and verbs with increasing AOA.

Our results differ from what might be predicted from the acquisition of English as an L1. Children learning English appear to have better control of nouns than verbs (e.g., Gentner, 1978, 1982; Nelson, 1973, 1988). However, evidence from studies by Choi and Gopnik (1995), Gopnik and Choi (1995), and Choi (2000) strongly suggested that differences in maternal input influenced the early vocabulary of children raised in different linguistic environments. These studies consistently found that English-speaking mothers used more nouns than verbs in addressing their children. In contrast, Korean-speaking mothers provided more verbs and fewer nouns and talked more about action than English-speaking mothers did (Choi & Gopnik, 1995) or else they provided a balanced treatment of nouns and verbs in speech addressed to their children (Choi, 2000). This difference in maternal input has been associated with differences in the early vocabulary of English- and Korean-speaking children. The early vocabulary of Korean-speaking children does not show a noun bias. Korean-speaking children acquire verbs earlier than English-speaking children, and they appear to have a verb spurt about a month before their first noun spurt (Choi, 1998). Thus, the role of the maternal input in shaping the composition of children's early vocabulary is emphasized in these studies.

In English, which is primarily a subject–verb–object language, nouns usually occupy the utterance-final position, whereas in Korean, which is primarily a subject–object–verb language, verbs are found at the end of utterances. Maternal input appears to favor the word class that usually occurs at the end of utterances (also described as the salient word in the sentence); this would be nouns in English and verbs in Korean (Choi, 1998, 2000; Choi & Gopnik, 1995; Gopnik & Choi, 1995). Thus, during language acquisition, Korean-speaking children devote more attention to verbs, whereas English-speaking children focus more on nouns.

It could be that, at an early stage of language development, word class categories are established in the mental lexicon, and the structure of the input language influences the hierarchy of accessibility. If this is true, then native Korean speakers would establish, from an early age, a mental lexicon in which verbs are stored differently from nouns and are more accessible than nouns. This mental set would then be carried over and strengthened into adulthood and

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

would later influence the way in which an L2 is learned. For Korean speakers learning English as an L2, it would mean that their mental set would lead them to focus more on verbs than nouns, which would result in better phonological and morphosyntactic control over verbs than nouns.

This explanation seems plausible for the Korean–English bilinguals in this study, who demonstrated better pronunciation and better detection of syntactic violations in verbs than nouns. The KB participants who had learned English after full mastery of Korean and who were dominant in Korean (AOA 12–23) were the ones who showed significant differences based on word class distinction by demonstrating a verb bias in their responses. The KB participants who were either balanced or dominant in English (AOA 6–11) did not show this difference; they pronounced nouns and verbs with equal accuracy. However, even for this group, their detection of syntactic violations was more accurate for verbs than nouns. An earlier study that used this grammaticality judgment test with native Korean and Chinese participants (Johnson & Newport, 1989) reported the same results: that is, more errors in detecting morphosyntactic violations in plural sentences than third person singular sentences. This finding runs counter to all expectations from developmental studies of learning English as an L1, in that it highlights the effects of L1 structure on L2 learning and does not support the notion of universal factors in learnability.

We cannot elaborate on how an increased focus on verbs than nouns would translate into differences in pronunciation or morphosyntactic skills between nouns and verbs. At present, we would suggest the possibility of linking the prominence of a given structure in an L1 to the familiarity and ease of learning that structure in an L2. It could be that Koreans who begin to learn English as adults are more familiar with English verbs than nouns and thus become more proficient in verbs. That is, the familiarity ratings of Francis and Kucera (1982), although valid for native English speakers, may not be psychologically valid for native Korean speakers. This possibility can be tested empirically. If this is true, then speakers of languages that emphasize nouns over verbs (e.g., English, French, or other SVO languages) would approach an L2 learning process with a mental set in which nouns would be more prominent than verbs. Such L2 learners would be expected to show higher accuracy in pronouncing or processing nouns than verbs.

Our preliminary results strongly suggest that pronunciation accuracy is influenced by the categorical organization of the lexicon. That is, the accuracy of production of phonetic segments is not constant in all words; rather, speech production accuracy is influenced by word class categories in the lexicon. In this context, we provide support for the multilevel speech production model posited by Levelt et al. (1991). We propose that late L2 learners whose L1 is well established will approach their L2 learning task with a linguistic mental set established from the structure of their L1, and that the hierarchies in their lexicon will influence learning in pronunciation and morphosyntax.

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

APPENDIX 1

The English sentences

S-1. Ron set a thick rug in the sun. [set, rug, sun]
S-2. Joe will feed the pup who sat by you. [Joe, feed, pup, sat]
S-3. Rick put the suit on a chair. [Rick, put, suit, chair]
S-4. Just obey this rule and good luck will come. [rule, come]
S-5. You should thank Sam for the food. [thank, Sam, food]
S-6. Sue could put her feet in the pool. [feet, pool]
S-7. Larry put the tool in his belt loop. [put, tool]
S-8. Fit a ring to the water tap. [fit, ring]
S-9. Beth will pick a child to sit on her lap. [pick, sit]
S-10. Get rid of the soot behind the seat. [get, rid, seat]
S-11. He used his fat thumb to shut the lid. [used, shut, lid]
S-12. Pat took the lead on the way to the ship. [Pat, took, way, ship]
S-13. Read the theme he wrote about the zoo. [read, theme, wrote]
S-14. It is fun to play chess with a rook. [play]
S-15. Tuck the sheet at the foot of the bed. [tuck, sheet, foot, bed]
S-16. Tom tried to shoot a rat near the shack. [Tom, tried, shoot]
S-17. Butch saw a root near the mountain peak. [saw, root, peak]
S-18. The tip of the cane was made of teak. [tip, cane, made, teak]
S-19. The good shoe fit Sue. [shoe, fit]
S-20. I can read this for you. [read]
S-21. The red book was good. [book]

Note: The nouns and verbs shown in brackets were selected for the word lists in Appendix 2.

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

APPENDIX 2

The initial consonant list

(Nouns)	(Verbs)
pup	put (S-3)
pool	put (S-7)
Pat	play
peak	pick
teak	took
tool	tuck
Tom	tried
food	feed
feet	fit (S-8)
foot	fit (S-19)
theme	thank
sun	set
suit	sat
Sam	sit
seat	saw
sheet	shut
shoe	shoot
rule	read (S-13)
root	read (S-20)
ring	wrote

The following vowel list

(Nouns)	(Verbs)
theme	feed
sheet	read
way	play
cane	made
Rick	fit
lid	pick
ship	sit
tip	rid
chair	set
bed	get
Sam	sat
food	shoot
root	used
Joe	wrote
foot	put
book	took
Tom	saw
rug	come
sun	shut
pup	tuck

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

APPENDIX 3

GRAMMATICALITY JUDGEMENT TEST

Nouns: Plural

The farmer bought two pigs (pig) at the market.
Todd has many coats (coat) in his closet.
Many houses (house) were destroyed by the flood last week.
Three boys (boy) played on the swings in the park.
Two mice (mouses) ran into the house this morning.
The boy lost two teeth (teeths) in the fight.
Mrs. Smith brought corn (corns) to the company picnic.
The girl's swimsuit is full of sand (sands).

Verbs: Third person singular

Every Friday our neighbor washes (wash) her car.
John's dog always waits (wait) for him at the corner.
Everyday Terry talks (talk) to her Mom on the phone.
Mrs. Sampson cleans (clean) her house every Wednesday.
Last night Mary walked (walks) to the store.
The man painted (paints) his house yesterday.
Yesterday the hunter shot (shoots) a deer.
The girl cooked (cooks) dinner for her family last night.

Note: The ungrammatical version is specified by the word in parentheses.

ACKNOWLEDGMENTS

Funding was provided by NIDCD Grant DC02892. We thank N. Bernstein Ratner for her helpful comments. We also thank the University of Maryland students who worked on this project: in particular, S. Kim and R. Byun for data collection and M. Cullen, P. Schmid, A. Kinn, and L. Fink for transcribing the sentences.

REFERENCES

Asher, J., & Garcia, R. (1969). The optimal age to learn a second language. *Modern Language Journal, 53,* 334–342.

Au, T. K., Dapretto, M., & Song, Y. K. (1994). Input vs. constraints: Early word acquisition in Korean and English. *Journal of Memory and Language, 33,* 567–582.

Birdsong, D. (Ed.). (1999). *Second language acquisition and the critical period hypothesis*. Mahwah, NJ: Erlbaum.

Camarata, S., & Leonard, L. B. (1986). Young children pronounce object words more accurately than action words. *Journal of Child Language, 13,* 51–65.

Camarata, S., & Schwartz, R. G. (1985). Production of object words and action words: Evidence for a relationship between phonology and semantics. *Journal of Speech and Hearing Research, 28,* 323–330.

Caramazza, A., & Hillis, A. E. (1991). Lexical organization of nouns and verbs in the brain. *Nature, 349,* 788–790.

Choi, S. (1998). Acquisition of Korean. In L. Leonard (Ed.), *Language acquisition in North America: Cross-cultural and cross-linguistic perspectives* (pp. 281–336). San Diego, CA: Singular.

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

(2000). Caregiver input in English and Korean: Use of nouns and verbs in book-reading and toy play contexts. *Journal of Child Language, 27,* 69–96.

Choi, S., & Gopnik, A. (1995). Early acquisition of verbs in Korean: A cross-linguistic study. *Journal of Child Language, 22,* 497–529.

Cochrane, R. M. (1980). The acquisition of /r/ and /l/ by Japanese children and adults learning English as a second language. *Journal of Multilingual and Multicultural Development, 1,* 331–359.

Fathman, A. (1975). The relationship between age and second language productive ability. *Language Learning, 25,* 245–253.

Flege, J. E. (1995). Second-language speech learning: Theory, findings and problems. In W. Strange (Ed.), *Speech perception and linguistic experience: Theoretical and methodological issues* (pp. 233–273). Timonium, MD: York Press.

(1999). Age of learning and second language speech. In D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis* (pp. 101–132). Mahwah, NJ: Erlbaum.

Flege, J. E., & Fletcher, K. L. (1992). Talker and listener effects on degree of perceived foreign accent. *Journal of the Acoustical Society of America, 91,* 370–389.

Flege, J. E., Munro, M., & MacKay, I. (1995). Factors affecting strength of perceived foreign accent in a second language. *Journal of the Acoustical Society of America, 97*(5), 1–10.

Flege, J. E., Yeni-Komshian, G. H., & Liu, S. (1999). Age constraints on second-language acquisition. *Journal of Memory and Language, 41,* 78–101.

Francis, W. N., & Kucera, H. (1982). *Frequency analysis of English usage: Lexicon and grammar*. Boston, MA: Houghton Mifflin.

Friederici, A. D. (1983). Aphasics' perception of words in sentential context: Some real-time processing evidence. *Neuropsychologia, 21,* 351–358.

(1985). Levels of processing and vocabulary types: Evidence from on-line comprehension in normals and agrammatics. *Cognition, 19,* 133–166.

Gentner, D. (1978). On relational meaning: The acquisition of verb meaning. *Child Development, 49,* 988–998.

(1982). Why nouns are learned before verbs: Linguistic relativity versus natural partitioning. In S. A. Kuczaj (Ed.), *Language development: Vol. 2: Syntax and semantics* (pp. 301–334). Hillsdale, NJ: Erlbaum.

Gopnik, A., & Choi, S. (1990). Do linguistic differences lead to cognitive differences? A cross-linguistic study of semantic and cognitive development. *First Language, 10,* 199–215.

(1995). Names, relational words, and cognitive development in English and Korean-speakers: Nouns are not always learned before verbs. In M. Tomasello & W. Merriman (Eds.), *Beyond names for things: Young children's acquisition of verbs* (pp. 63–80). Hillsdale, NJ: Erlbaum.

Gopnik, A., & Meltzoff, A. (1993). Words and thoughts in infancy: The specificity hypothesis and the development of categorization and naming. In C. Rovee-Collier & L. P. Lipsitt (Eds.), *Advances in infancy research* (pp. 217–249). Norwood, NJ: Ablex.

Johnson, J., & Newport, E. (1989). Critical period effects in second language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology, 21,* 60–99.

Levelt, W., Schriefers, H., Vorberg, D., Meyer, A., Pechmann, T., & Havinga, J. (1991). The time course of lexical access in speech production: A study of picture naming. *Psychological Review, 98,* 122–142.

Long, M. (1990). Maturational constraints on language development. *Studies in Second Language Acquisition, 12,* 251–285.

McCarthy, R., & Warrington, E. K. (1985). Category specificity in an agrammatic patient: The relative impairment of verb retrieval and comprehension. *Neuropsychologia, 23,* 709–727.

Miceli, G., Silveri, M. C., Villa, G., & Caramazza, A. (1984). On the basis for the agrammatic's difficulty in producing main verbs. *Cortex, 20,* 207–220.

Nelson, K. (1973). Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development, 38* (Serial No. 149).

(1988). Constraints on word learning? *Cognitive Development, 3,* 221–246.

Oyama, S. (1979). The concept of the sensitive period in developmental studies. *Merrill-Palmer Quarterly, 25,* 83–102.

Patkowski, M. S. (1990). Age and accent in a second language: A reply to James Emil Flege. *Applied Linguistics, 11,* 73–89.

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

Suter, R. W. (1976). Predictors of pronunciation accuracy in second language learning. *Language Learning, 26,* 233–253.

Swinney, D. A., Zurif, E. B., & Cutler, A. (1980). Effects of sentential stress and word class upon comprehension in Broca's aphasics. *Brain and Language, 10,* 132–144.

Tahta, S., Wood, M., & Loewenthal, K. (1981). Foreign accents: Factors relating to transfer of accent from the first language to a second language. *Language and Speech, 24,* 265–272.

Tardif, T. (1996). Nouns are not always learned before verbs: Evidence from Mandarin speakers' early vocabularies. *Developmental Psychology, 32,* 492–504.

Thompson, I. (1991). Foreign accents revisited: The English pronunciation of Russian immigrants. *Language Learning, 41,* 177–203.

Yeni-Komshian, G., Flege, J. E., & Liu, S. (2000). Pronunciation proficiency in first and second languages of Korean–English bilinguals. *Bilingualism: Language and Cognition, 3,* 131–149.

Zingeser, L. B., & Berndt, R. S. (1988). Grammatical class and context effects in a case of pure anomia: Implications for models of language production. *Cognitive Neuropsychology, 5,* 473–516.

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press

https://doi.org/10.1017/S0142716401003010 Published online by Cambridge University Press