Explaining Chinese Learners' Errors in the Phonological Representations of Latinate Derivatives in English: A Psycholinguistic Perspective

Siok H. Lee
Burnaby School District and Simon Fraser University

Stephen Carey
University of British Columbia

Investigations of ESL pronunciation have focused on segments, syllable structure and prosody. This study examines the phonological representations of English Latinate derivatives of 32 Cantonese speakers and 32 native speakers (NS) from the perspectives of morphophonemics and word association. The subjects (Grade 12) performed tests on listening, pronunciation and semantic rating of word pairs. The results confirmed the hypothesis that in the absence of analogous morphological and morphophonemic features in the L1, base-word pronunciation was the dominant error type for both learners and the NS subjects. As both groups showed comparable rates of recognition of the semantic association between morphologically related words, this recognition seems to account for the dominant error type of both ESL and NS groups.

Jusqu'à présent, les recherches sur la prononciation de l'anglais langue seconde ont porté sur les segments, sur la structure syllabique ainsi que sur la prosodie. Cette étude se penche sur les représentations phonologiques des dérivés latinisants pour 32 locuteurs chinois et 32 locuteurs natifs (LN) de l'anglais. Elle s'inscrit dans une perspective morphophonémique et associative des mots. Les sujets (12e année) ont répondu à des tests d'écoute, de prononciation et de classement sémantique de paires de mots. Les résultats confirment qu'en l'absence de traits morphologiques et morphophonémiques analogues à ceux de la L1, les erreurs de prononciation des mots de base dominent, résultat qui concorde d'ailleurs avec celui obtenu par le groupe LN. Bien que les deux groupes démontrent un niveau comparable de reconaissance quant aux associations sémantiques entre des mots morphologiquement liés, cette reconaissance semble rendre compte du type dominant d'erreur chez le groupe de locuteurs de l'anglais langue seconde.

Address for correspondence: Siok H. Lee, 5325 Kincaid St., Burnaby, BC, V5G 1W2.
E-mail: slee@alpha.sd41.bc.ca.
Stephen Carey, Department of Language and Literacy Education, Faculty of Education, University of British Columbia, Vancouver, BC, V6T 1Z5.
E-mail: stephen.carey@ubc.ca.

Past research on ESL/EFL learners' pronunciation of English multisyllabic words, including derivatives, has focused on the effects of L1 phonology. According to Anani (1989), learners' stress errors in English multisyllabic words are due to similarities in syllable structure between English and the L1 of Jordanian Arabic. Contrary to Anani (1989), Mairs (1989) links the errors of stress assignment for Spanish learners of English with differences in syllable structure between English and Spanish. Fokes and Bond (1989) explain the pronunciation errors of Chinese and Hausa speakers by citing the negative influence of syllable-timed L1 prosody on stress-timed English derivatives, with the number of syllables of target words also being a factor. Erdman (1973) explains the stress errors of German learners of English by the adaptation of L1 stress rules on the pronunciation of English cognates, including derivatives. Baptista (1989) also traces Portuguese learners' pronunciation errors in multisyllabic English words to the adaptation of L1 stress rules. However, unlike Erdman (1973), Baptista isolated derivatives from the other multisyllabic words in her test sample and cites the incorporation of base-word stress as the main error type in the subjects' pronunciation of English Latinate derivatives which are cognates and non-cognates.

Latinate derivatives, as distinguished from Anglo-Saxon derivatives, are multimorphemic words whose roots and affixes are of Greek or Latin origin. In Latinate derivatives, affixation of base words leads to morphophonemic alternations (vowel and/or stress shifts with or without consonant changes) in the base words. What is evident so far is that, except for Baptista (1989), all the studies cited above have treated derivatives as phonological units. Latinate derivatives are not differentiated from other multisyllabic words such as inflected words, compounds, Anglo-Saxon derivatives or even monomorphemic words. As a result, learners' pronunciation problems with Latinate derivatives have been viewed simply as phonological problems involving segments, syllable structure and word-internal prosody. The morphological and morphophonemic properties of multisyllabic words, especially stress and vowel alternations between base words and associated derivatives, were not considered by Baptista in the analysis of learners' pronunciation problems. Therefore, the possibility that learners' phonological problems with derivatives could be related to their mental representations of derivatives in terms of the meaning associations they make with related base words has not been explored. This means that derivatives have been treated as isolated items in the learners' lexicons, unrelated to other morphologically or semantically associated words known to them. Consequently, errors in the pronunciation of derivatives are seen as problems in L2 phonology and not L2 morphophonemics.

The general agreement among empirical psycholinguistic models of the L1 regarding the lexical representations of derivatives is that morphologically related words are grouped together in the speaker's lexicon (Bradley, 1980;

Luketala *et al*., 1980; Cutler *et al*., 1985; Anshen and Aronoff, 1988). The linguistic competence of native speakers (NS) includes their recognition of morpheme identity and the semantic relationships between words in a morphological family, so that morphological relationships play an important role in word recognition (Derwing, 1973; Murrell and Morton, 1974; Derwing and Baker, 1977; Stanners *et al*., 1979; Nagy *et al*., 1989; Bentin and Feldman, 1990; Stolz and Feldman, 1995). According to Stolz and Feldman (1995), morphemes form stronger lexical access codes than syllables and syllabic letter groupings. In the process of acquiring words in their different parts of speech, it is also likely that the lexicons of learners, like those of native speakers, would have words that are morphologically and semantically associated. It is then logical to assume that advanced ESL learners who are familiar with English word morphology are likely to use their knowledge of meaning association in their pronunciation of derivatives.

Research on ESL/EFL learners' phonological representations, in terms of perception and production, has largely overlooked the problems of derivational morphophonemics and the relationship between learners' listening and pronunciation performance and their knowledge of word association. Investigations have traditionally focused on the perception and production of segments and the problems of syllable structure or word-internal prosody (Stevens *et al*., 1969; Groto, 1971; Miyawaki *et al*., 1975; Oyama, 1976; MacKain *et al*., 1981; Mochizuki, 1981; Sheldon and Strange, 1982; Flege and Davidian, 1984; Gass, 1984; Broselow, 1992; Stockman and Pluut, 1992; Flege *et al*., 1995; Hardison, 1996; Major and Kim, 1996; articles in Ioup and Weinberger (eds.), 1987). Furthermore, studies in interlanguage morphology and morphophonemics have focused largely on inflection, not derivation. As mentioned before, studies on the phonological problems of derivatives have focused on segments, prosody and syllable structure, not morphophonemics. According to James (1987), an adequate account of the acquisition of the L2 sound system would include the learner's conception of the different levels of the sound system of the language, that is, the morphophonemics of inflection and of derivatives. Therefore, learners' conception of the morphophemics of English derivatives needs to be examined.

Word association and phonological representations of Latinate derivatives

The dominance of L1 phonology as a factor accounting for L2 pronunciation errors, including those for derivatives, stems from the influence of the theory of transfer in L2 learning and the significance of cross-linguistic influence (Ringbom and Palmberg, 1976; Schachter and Rutherford, 1979; Broselow, 1992). The problem with the theory of transfer is that positive or negative transfer cannot account for the learner's interlanguage errors where a target

linguistic feature has no correlate in a learner's L1. Hammerly (1991) cites inhibition as a source of learner errors due to the learner's resistance to learning the target language (TL) rules which do not exist in the L1. However, inhibition, like negative transfer, cannot account for the errors that result from a learner's attempts to apply particular TL rules not found in the L1. Schachter's (1992) redefinition of language transfer as a constraint rather than a process is thus useful. The constraint is imposed by previous knowledge (the L1 and any other language known by the learner). Where the L1 has no rules analogous to TL rules, the constraints are imposed by TL rules that learners, especially advanced learners, might construct. These rules are idiosyncratic interlanguage rules constructed by the learner based on reasoning and analogy of similar linguistic features encountered earlier in the TL. In this case, learners are likely to use rules for pronouncing Anglo-Saxon derivatives that they have encountered earlier in their pronunciation of Latinate derivatives. Thus, the problems of Chinese learners' pronunciation of Latinate derivatives may stem from more than just vowel tension and reduction or syllable-timed or stress-timed prosody as proposed in earlier studies, but from the overgeneralization of the pronunciation rules of Anglo-Saxon derivatives that do not require vowel or stress alternations. It may be assumed that learners acquire Anglo-Saxon derivatives before Latinate derivatives.

Baptista's (1989) finding that root-word (base word) stress was a problem in non-native pronunciation of derivatives is valid, but the study has three limitations. Firstly, the subjects' pronunciation of root words is not examined; the basis for claiming that errors stem from "root-word stress" is therefore absent. It is simply assumed that the subjects' base-word phonology would be that of the native speaker. Secondly, only base-word stress is taken into account and the possibility of base-word segments being replicated in derivatives is not examined. Thirdly, the relationship between the subjects' semantic representations of base word-derived word pairs and their pronunciation of base words and associated derivatives is not examined. It is likely that the semantic relationships between morphologically associated words in English are recognized by learners whose L1s are rich in morphology and morphophonemics. This may not be the case for learners whose L1, for example, Cantonese Chinese, lacks derivational affixation and morphophonemic rules related to such affixation.

Another problem in phonological investigations so far is the question of transferability of linguistic features. The theory of overgeneralization in interlanguage morphology and morphophonemics proposed by Singh (1988, 1991), Singh and Ford (1987) and Singh and Martohardjono (1988) states that L1 morphological and morphophonemic rules, unlike phonological rules, are not subject to transfer in L2 learning. Evidence from the interlanguage English of Hindi speakers and the interlanguage German and French of English speakers has confirmed that morphological and morphophonemic errors are "L2

induced" overgeneralizations or illegal extensions of L2 rules (Singh, 1991). In the case of Chinese ESL learners, it may be hypothesized that overgeneralization takes place because two semantically associated words should be pronounced the same way, as in Anglo-Saxon derivatives (e.g. *happy* ~ *happiness*). It may also be assumed that this overgeneralization is part of the process of linguistic simplification in interlanguage. Cutler's (1981) psycholinguistic evidence of English native speakers' production of derivatives also confirms their preference for transparent derivations over opaque ones (e.g. saying "*professoral" rather than "professorial"). Therefore, we may assume that for speakers and learners whose L1s have no analogous derivational morphophonemics, errors in the phonological representations of English Latinate derivatives that require vowel and stress shifts stem from the pronunciation rules of the more familiar Anglo-Saxon derivatives.

An interesting consideration, and one that explains the need to compare native speakers' errors and learners' errors in the pronunciation of English Latinate derivatives, is the psycholinguistic evidence of the pronunciation errors of native speakers for words involving vowel and stress shifts. Chomsky and Halle (1968) and Kiparsky (1982) propose the theory of strata or levels of affixation in Latinate derivatives. This theory has sparked debate over the psychological reality of the step-by-step vowel and stress alternations and of the claim that vowel shift is directed by innate knowledge possessed by native speakers of English. Studies by Jaeger (1984, 1986), McCawley (1986), Ohala (1986) and Wang and Derwing (1986) (see also the *Phonology Yearbook 3*, 1986) confirm that vowel and stress shifts in Latinate derivatives are not automatic for native speakers, but are learned in school through familiarization with English spelling rules. Dziubalska-Kolaczyk (1992) confirms that learners and speakers manifest the same difficulties in vowel and stress shifts, with education in linguistics influencing the accuracy in the application of these rules in pseudo-words containing the suffix *-ity*.

In the present account of our subjects' problems with the phonological representations of derivatives, we have attempted to go beyond surface phonological problems to investigate the subjects' morphophonemic representations of base words and derivatives based on their meaning associations. We assumed that the learners would use their knowledge of semantic associations between base words and derivatives to help them determine the pronunciations of derivatives.

In the present study, derivatives and their associated base words were distinguished from other multisyllabic words such as inflected words and monomorphemic words. To exclude the possible effects of direct positive or negative transfer of L1 on the subjects' performance on the tests on listening, pronunciation and semantic rating, Cantonese-speaking ESL learners were selected for the study group for several reasons. Cantonese lacks derivational

affixation and morphophonemic rules related to such affixation, has no cognates with English and is tonal and syllable-timed rather than stress-timed. The ESL subjects' errors in phonological representations were also compared with those of native speaker subjects on the assumption that, without analogous linguistic features in their L1, the learners would display errors that reflect the learning strategies of native speakers of the language. These strategies are simplification and reasoning by analogy from Anglo-Saxon derivatives. Therefore, comparing the performance of Cantonese ESL learners and native speakers of English provides two advantages. We would be able to determine the common pronunciation errors between the two groups as well as the factors that influence the overgeneralization of phonological representations of Latinate derivatives in both groups.

Hypotheses

The three hypotheses proposed here are based on two considerations: that semantic association between base words and derivatives influences learners' phonological representations of Latinate derivatives and that both the ESL and NS subjects are dependent on the strategies of simplification and reasoning by analogy with Anglo-Saxon derivatives. The three hypotheses investigated were:

Hypothesis 1

The main type of error in the aural recognition of Latinate derivatives of the ESL subjects and the NS subjects will be the incorporation of base-word pronunciation in the pronunciation of Latinate derivatives rather than other errors of segmental alternations and stress shift, e.g. [ˈæksədəntl̩] rather than [ˌæksəˈdɛntl̩] for *accidental* ([accident] + [al]).[1]

Hypothesis 2

The main type of error in the oral production of Latinate derivatives of the ESL subjects and NS subjects will be the incorporation of base-word pronunciation in the production of Latinate derivatives rather than other errors of segmental alternations and stress shift, e.g. [ˈprɑsˌpərəti] rather than [ˌprɑsˈpɛrəti] for *prosperity* ([prosper] + [ity]).

Hypothesis 3

The incorporation of base-word pronunciation in the aural recognition and oral production of Latinate derivatives is based on ESL learners' and native speakers' perception of the semantic association between morphologically related words (e.g. *prosper* ~ *prosperity*).

Method

Subjects

The subjects were 64 Grade 12 students enrolled in English 12 and other content area programs in a public high school in Greater Vancouver. The study group, referred to here as the ESL group, consisted of 32 Cantonese-speaking students from Hong Kong aged between 17;0 and 18;11 (average age 17;6). The ESL learners had received between eight and eleven years of ESL instruction in Hong Kong prior to arrival in Canada and the average length of residence and attendance at school in Canada was 31.81 months. They had completed programs in ESL as well as Transitional English and Transitional Social Studies in Canada. They had also passed school-based proficiency tests for entry into Regular English. They were enrolled in Mandarin as a Second Language or Japanese as a Second Language to fulfil university admission requirements. The reference group, the NS subjects, consisted of 32 native speakers of Canadian English aged between 17;0 and 18;11 (average age 17;7). They were enrolled in English 12 (Regular Program). They were monolingual English speakers and were enrolled in French, Spanish or Italian to fulfil university admission requirements.

Procedure

Questionnaires

Prior to the study, both groups completed questionnaires to ascertain that English was the mother tongue of the NS subjects and that Cantonese was the mother tongue of the ESL subjects. It also ascertained that exposure to formal ESL instruction was comparable among the ESL subjects.

Tests

All the Latinate derivatives used on the listening test, pronunciation test and semantic rating of word pairs test were selected based on three of Carlisle's (1988) four types of transformation between base word and derived form involving phonological change, accompanied by or unaccompanied by orthographic change. All items required vowel alternations and stress shifts from their bases. These were:

a) stress shift and reduction of a vowel to a schwa (e.g. *explain* ~ *explanation*)

b) stress shift and expansion of a schwa to a full vowel (e.g. *accident* ~ *accidental*)

c) stress shift, vowel reduction and consonant change (e.g. *magic* ~ *magician*)

In addition, the following were included:

d) reduction of a diphthong to a schwa (e.g. *combine* ~ *combination*);

e) stress shift and expansion of a tense vowel to a diphthong and monophthong (e.g. *vary* ~ *variety*)

f) expansion of a glide and a schwa to two vowels (e.g. *Christian* ~ *Christianity*)

Besides these phonological criteria, the most important criterion for selecting test items was their frequency of everyday use in school (administration, content area learning such as English, Social Studies, and Science, student counselling, sports and extracurricular activities) and out of school (general interest, community living, and news and media). However, these words were not "highly technical" or "specialized". All items were also checked against *The American Heritage Word Frequency Book* (Carroll, Davies and Richman, 1971) for their frequency and the grade level at which they were first encountered in North American schools. In addition, four content-area teachers (English, Social Studies, Math and Science) were consulted, and they confirmed that ESL students who had gone through the ESL and transitional content programs could be expected to be familiar with the test words upon entry to regular Grade 11 and 12 content-area subjects.

The listening, pronunciation and semantic rating of word pairs tests were conducted in this sequence in order not to sensitize the subjects to the linguistic variables of the tests.

The listening test items consisted of 30 Latinate derivatives randomly selected from the pronunciation test items.[2] All of them required stress and vowel alternations from their base word forms. The derivatives were:

aborigines	*desperation*	*mechanism*
accidental	*elementary*	*nationality*
authority	*explanation*	*political*
biological	*exploration*	*popularity*
Christianity	*formality*	*preparation*
combination	*grammatical*	*prosperity*
comparable	*influential*	*recitation*
confidential	*inventory*	*references*
continental	*magnetic*	*reservation*
declaration	*majority*	*variety*

Before the listening test, each subject was given three minutes to preview the list of 30 test items which they could retain during the test if they wished. During the test, each test item was presented visually on a bright yellow card with large black letters. The three pronunciations of each word were read by a graduate student in linguistics who was a native speaker of North American English. These pronunciations were prerecorded on a cassette tape. The three

pronunciations given for each word were the correct pronunciation, a pronunciation incorporating base-word vowel(s) and stress pattern, and a pronunciation incorporating correct vowel and incorrect stress pattern (other than base-word stress pattern.) (The three pronunciations of each word were selected based on the researchers' observation of ESL learners' common errors in vowels and stress in derivatives.) For example, for the derivative "mechanism," the following options were provided:

A. [məˈkænɪzm̩]

B. [ˈmɛkənɪzm̩]

C. [ˌmɛkəˈnɪzm̩]

D. None of the above

The order of presentation of these three pronunciation types varied for the different test items. The option "None of the Above" was given as a fourth option for every test item. The subjects indicated their choice of pronunciation for each test item by blackening the relevant letter on a multiple-choice answer sheet. No phonetic transcription of the pronunciations was given. All the thirty test items were played through, with a pause of three seconds between the alternative pronunciations of an item and a pause of 10 seconds between items. Then the whole test was replayed with the same pauses. The subjects were instructed to request replays of any specific item when necessary. (Two trials with a non-test item were carried out before the actual test.) No related base words were presented visually or orally to the subjects.

The pronunciation test consisted of 120 items, 60 base words and 60 associated derivatives (see Appendix). To reduce priming effects, there was a lapse of five days between the recording of the subjects' pronunciation of base words in the first session and their pronunciation of the associated derivatives in the second session. In the first pronunciation session, only base words were on the pronunciation list, and in the second session, only the derivatives were on the pronunciation list. All the subjects of both groups were recorded for the pronunciation of base words before they were recorded for derivatives. Each subject was allowed five minutes to preview the printed list of test words. No help was given to the subjects during the preview. The subjects were called to the test location one by one where they read aloud from the word list and their pronunciation was tape-recorded. The subjects were allowed to self-correct as many times as they wished. The word list was collected from each subject after recording.

From the pronunciation test, each of the 60 base words was paired with its associated derivative to make up the semantic rating of word pairs test (see Appendix[3]). In this test, the subjects rated the extent of semantic relatedness between the base word and the associated derivative of each pair, using a scale

of 1 through 5, "1" representing "definitely not related in meaning", and "5" representing "definitely related in meaning". The subjects circled the number of their choice beside each pair. The subjects were instructed to rate a pair of words only when they knew the meanings of both words in the pair, and not to rate a pair in which one or both words were not known. They were instructed to indicate which word or words they did not know the meanings of by crossing them out on the test. No examples were given as trial items.

Scoring and rating system

The listening test and the semantic rating of word pairs test were scored by the principal investigator. The pronunciation test was scored by a native speaker of North American English trained in linguistics and the teaching of ESL. In the initial assessment of pronunciation, both base words and derivatives were assessed for intelligibility only. Unclear pronunciation, or pronunciation that resembled another word in English or did not correspond to the target word, was classified as "Not Intelligible". If a subject self-corrected, the best pronunciation (the clearest and/or the pronunciation that contained the least number of error features such as stress and segmental errors) was taken to be the pronunciation given by the subject. In the second analysis, the criteria for assessing the pronunciation of the derived word as acceptable and close to NS norm were that the stress placement must be correct and the vowel alternation (and consonant alternation if required) must be judged by the NS rater as corresponding to, or coming close to, the educated NS norm. In general, the prominence of primary stress, the duration of tense vowels or lax vowels, or the extent of reduction of unstressed syllables might not exactly resemble those of native speakers. The main criterion was that any required segmental alternations and stress shifts must be, for the NS rater, audibly "different" from the related base word, and segments were recognizable as reflecting the correct morphophonemic alternations required in the derivatives. In counting the number of base words or derivatives that were native-like in production for each subject, both words of a pair, that is, the base word and its associated derivative, need not be intelligible. In assessing the error type in the production of derivatives, both words of a pair must be intelligible for each subject. This was to ensure that there was a basis for claiming that the subjects' base-word pronunciation influenced their production of associated derivatives.

Results and Discussion

Listening test

For the ESL group, the listening test scores ranged between 13 (43.33%) and 25 (83.33%) correct out of 30 test items, that is, between 43.33% and 83.33% correct responses. For the NS group, the scores ranged between 26 (86.67%)

and 30 (100%). The mean scores on the listening test for the ESL group and the NS group were 67.60% and 94.79% respectively.

Table 1 shows the subjects' responses on the listening test. In the discussion of errors below, the following notations are used:

i) [−vowel, −stress] stands for pronunciations of derivatives containing base word vowel and base word stress pattern (both vowel and stress are incorrect), e.g. [məˈkænɪzm̩].

ii) [+vowel, −stress] stands for pronunciations of derivatives containing correct vowel and incorrect stress pattern, but not resembling the base word vowel and base word stress pattern, e.g. [ˌmɛkəˈnɪzm̩].

iii) "Other" stands for the option "None of the Above."

Table 1: ESL and NS subjects: Pronunciation errors on the listening test

[−vowel, −stress]		[+vowel, −stress]		"Other"	
ESL (311 errors)	NS (50 errors)	ESL (311 errors)	NS (50 errors)	ESL (311 errors)	NS (50 errors)
183/311 = 58.84%	40/50 = 80.00%	98/311 = 31.51%	4/50 = 8.00%	30/311 = 9.65%	6/311 = 1.93%
Average: 5.72	1.25	Average: 3.06	0.13	Average: 0.94	0.19

For the ESL group, 58.84% of the 311 errors were [−vowel, −stress]; 31.51% were [+vowel, −stress], and 9.65% were "Other". Therefore, there were almost twice as many [−vowel, −stress] errors as [+vowel, −stress] errors. The ESL group had an average of 5.72 [−vowel, −stress] errors, compared with the average of 3.06 [+vowel, −stress] errors. An ANOVA test and post hoc Tukey tests showed that for the ESL group, [−vowel, −stress] was the significantly dominant error type in perception ([$F(3, 93) = 401.40$] $p < 0.01$). Considering individual ESL subjects, 25 of the 32 subjects (78.13%) favoured [−vowel, −stress] pronunciations over [+vowel, −stress] pronunciations. Of these subjects, 20% selected twice as many [−vowel, −stress] words as [+vowel, −stress] words. As well, 44.00% had more than twice as many [−vowel, −stress] errors as [+vowel, −stress] errors. For one ESL subject, all errors were [−vowel, −stress]. Thus, base-word vowel and base-word stress was dominant in the ESL subjects' phonological representations of derivatives.

Considering individual test items for the ESL group, 16 out of 29 test items with errors had more [−vowel, −stress] errors than [+vowel, −stress] errors. For these 16 words, [−vowel, −stress] errors exceeded [+vowel, −stress] errors by between one and 28. For 12 words, [+vowel, −stress] errors exceeded [−vowel, −stress] errors. The [+vowel, −stress] errors ranged between one and

12. Therefore, a larger number of test items had higher numbers of [−vowel, −stress] errors than [+vowel, −stress] errors. "Other" errors made up only 9.65% of all errors for the ESL group, and 37.50% of the ESL subjects had no "Other" errors.

For the NS group, 80.00% of the 50 errors were [−vowel, −stress] errors, 8.00% were [+vowel, −stress] errors, and 1.93% were "Other". The average number of [−vowel, −stress] errors for the NS group was 1.25; that for [+vowel, −stress] errors was 0.13; and that for "Other" was 0.19. An ANOVA test and post hoc Tukey tests also showed that [−vowel, −stress] was the significantly dominant error type ($F(3, 93) = 8395.11, p < 0.01$). For the NS group, out of the 12 test items with errors, ten items had [−vowel, −stress] errors. The average number of [−vowel, −stress] errors for the NS group was several times greater than that of [+vowel, −stress] errors. This was in contrast to [−vowel, −stress] errors being just double that of [+vowel, −stress] errors for the ESL group.

These results showed that for the ESL subjects, simplification of the rules for the phonological representations of English Latinate derivatives was the dominant strategy in their aural recognition of Latinate derivatives. In their aural recognition of Latinate derivatives, incorporating base-word stress and vowel patterns was more common than the strategy of making stress shifts and vowel alternations. Therefore, Hypothesis 1 was confirmed. In the aural recognition of English Latinate derivatives, the main type of error in the pronunciation preference of ESL and NS subjects was a base-word vowel and stress pattern rather than other types of errors involving stress placement and segmental alternations. This tendency was found to be statistically significant for both ESL and NS groups.

The relative difficulty of derivatives based on suffix types was not assessed due to the uneven distribution of suffix types in the test items. The main objective of the test was to examine the ESL subjects' aural recognition of known or familiar words rather than words with different suffixes. Different suffixes were represented in both [−vowel, −stress] and [+vowel, −stress] errors. However, the limited evidence from the eight words ending with *-ation*, the seven words ending with *-ity*, and the five words ending with *-al* seemed to indicate that words ending with the same suffix posed varying levels of difficulty for the ESL subjects. The percentage of ESL subjects who had correct aural recognition of *-ation* words ranged between 90.63% for *recitation* and 25.00% for *declaration*. The percentage of ESL subjects who had correct aural recognition of *-ity* words ranged between 90.63% for *nationality* and *popularity*, and 53.13% for *Christianity*. The correct aural recognition of *-al* words ranged between 75.00% for *accidental* and 100.00% for *political*. It might be said that correct recognition was higher for more frequent words, and that the ESL subjects had not yet formed their own rules for vowel and stress alternations in derivatives based on specific suffix types.

The 67.60% score for correct aural recognition and the 31.51% preference for pronunciations with [+vowel, −stress] pattern also showed that the ESL subjects were aware, to different extents, of the need for stress shift and vowel alternations in Latinate derivatives. They were beginning to notice stress shifts and vowel alternations in derivatives in perception.

Pronunciation test

In the following discussion, the abbreviations "IP" stands for "intelligible pronunciation" and "NS norm" stands for "acceptable or close to NS norm of pronunciation according to the assessment of the native-speaker rater."

Table 2: ESL and NS subjects: Results of pronunciation test

	Base Words (intelligible)	Base Words (NS norm)	Derived Words (intelligible)	Derived Words (NS norm)
ESL group	1850/1920 = 96.35%	1443/1920 = 75.16%	1756/1920 = 91.46%	744/1920 = 38.75%
Range:	51–60	35–54	38–60	6–37
Average:	57.81	45.09	54.88	23.25
NS group	1913/1920 = 99.54%	1903/1920 = 99.11%	1912/1920 = 99.58%	1822/1920 = 94.90%
Range:	57–60	57–60	57–60	54–59
Average:	59.78	59.47	59.75	56.94

Table 2 shows the pronunciation scores of the ESL group and the NS group. For the ESL group, 1727 word pairs (both base word and associated derivative of each pair) or 89.95% of the possible 1920 word pairs had IP. Of these 1727 IP pairs, 718 pairs (or 37.40% of 1920 pairs) met native speaker pronunciation criteria. For individual subjects, between six and 24 word pairs out of 60 met criteria, the average being 22.44 pairs (out of 60). Of the IP word pairs for this group, 1009 pairs (52.55% of 1920 pairs) contained pronunciation errors, either in the derivatives or in the associated base words. The number of word pairs with IP for the ESL group ranged between 37 and 60 (out of 60), or between 61.67% and 100.00%, averaging at 31.53 pairs (out of 60) with pronunciation errors. For the NS group, 1911 pairs had IP out of a possible 1920 pairs (99.53%). Of the 1911 IP word pairs, 1827 pairs (or 95.16% of 1920 pairs) met correct pronunciation criteria. The average number word pairs per NS subject that met criteria was 57.09. For individual subjects, between 54 and 59 word pairs out of 60 met criteria. Of the 1911 IP word pairs for this group, 84 pairs (or 4.38% of 1920 pairs) contained pronunciation errors, either in the derivatives or in the associated base words. The number of word pairs with IP for the NS group

ranged between 56 and 60 (out of 60), or between 93.33% and 100.00%. The average number of word pairs with IP per NS subject was 59.72%.

Table 3 shows the error types in the pronunciation test for both groups. Eight error types were observed in the ESL subjects' production of the 60 word pairs while seven error types were observed in the NS subjects' pronunciation of the word pairs. The term "base word" refers to the morphologically simpler word in a word pair. For the first seven error types shown in Table 3, two-character symbols were used to represent error types. The first symbol stands for vowel pattern and the second for stress pattern. The eighth error type, involving only a consonant error, was represented by a single character. The eight error types were:

BB: base-word vowel(s) and base-word stress pattern e.g. [ˈgræmə] ~ *[ˈgræməˌtɪkl̩] for *grammar* ~ *grammatical* and *[dəˈmɔkrət] ~ [dəˈmɔkrəsi] for *democracy* ~ *democratic*. BB errors might contain a correctly pronounced base word and an incorrectly pronounced derivative and vice-versa. The criterion for BB was that the subject's pronunciation of the base word part of the derivative resembled the pronunciation of the base word.

B√: base word vowel (s) but correct stress pattern e.g. [ˌrɪˈzɑɪn] ~ *[ˌrɪzɑɪˈneʃn̩] for *resign* ~ *resignation*.

XB: incorrect vowel(s) (other than base word vowel) and base-word stress pattern e.g. [ˈstebl̩] ~ *[ˈstæbəlɪti] for *stable* ~ *stability*.

BX: base-word vowel(s) and incorrect stress pattern (other than base-word stress pattern) e.g. [ˌrɪˈzɜrv] ~ *[ˈrɪˌzɜrveʃn̩] for *reserve* ~ *reservation*.

X√: incorrect vowel(s) (other than base-word vowel) but correct stress pattern e.g. [ˈsɪmələr] ~ *[sɪməˈlɜrəti] for *similar* ~ *similarity*.

√X: correct vowel but incorrect stress pattern (other than base-word stress pattern) e.g. [ɪˈkɔnəmi] ~ *[ˈɪkəˌnɔmɪkl̩] for *economy* ~ *economical*.

XX: incorrect vowel(s) (other than base-word vowel(s)) and incorrect stress pattern (other than base-word stress pattern) e.g. [ˈgræmə] ~ *[ˌgræˈmætɪkl̩] for *grammar* ~ *grammatical*.

C: incorrect consonant e.g. [ˈkɑnfədənt] ~ *[ˌkɑnfəˈdɛnt ɪəl] for *confident* ~ *confidential*.

A word pair containing an (X√) error as well as a (C) error was recorded as having two error types.

Table 3: ESL and NS subjects: Error types in the pronunciation test

Intelligible word pairs containing errors	Type 1 BB	Type 2 B√	Type 3 XB	Type 4 BX	Type 5 X√	Type 6 √X	Type 7 XX	Type 8 C
ESL group (1009)	449	23	16	196	66	50	197	37
NS group (84)	58	15	1	2	4	3	1	0
ESL group:								
% out of 1009 pairs	44.50	2.28	1.59	19.43	6.54	4.96	19.52	3.67
NS group:								
% out of 84 pairs	69.05	17.86	1.19	2.38	4.76	3.57	1.19	0.00
Average:								
ESL group:	14.03	0.72	0.50	6.13	2.06	1.56	6.16	1.16
NS group:	1.81	0.47	0.03	0.13	0.09	0.03	0.03	0.00
χ^2 (7)								
ESL group:	1195.29**							
NS group:	269.07**							
$^{**}p < 0.01$								

Note: In the two-character symbols for error types, the first character represents vowel(s) and the second character represents stress pattern.

BB = base word vowel(s), base word stress
√ = correct
X = incorrect
C = consonant error

For the ESL group, of the 1009 pairs that contained errors, Type 1 (BB) was dominant, constituting 44.50% (449 pairs) of all errors. This was followed by Type 7 (XX), which accounted for 19.52% of errors (197 pairs) and Type 4 (BX), which accounted for 19.43% (196 pairs). The chi-square test performed on the eight error types for frequency distribution confirmed that the predominance of Type 1 (BB) was statistically significant ($\chi^2(7) = 1195.29, p$ <0.01; see Table 3). Type 1 (BB) was dominant for 29 ESL subjects (90.63%) and for 36 out of the 60 word pairs (60.00%). Type 7 (XX) was dominant for one subject only (0.03%) and for 10 out of the 60 word pairs (16.67%). Type 4 (BX) was not a dominant error type for any subject, but it was the dominant error type for 11 out of the 60 word pairs (18.33%).

For the NS group, of the 84 intelligible word pairs with errors, Type 1 (BB) with 58 pairs, was the dominant error type, making up 69.05% of all errors. This was followed by Type 2 (B√) with 15 pairs (17.86%) of all errors. The other error types were notably infrequent. There were no Type 8 (C) errors. The chi-square test performed on the eight error types for frequency distribution confirmed the predominance of Type 1 (BB) to be statistically significant ($\chi^2(7) = 269.07, p$ <0.01). For the nine NS subjects (28.13%) who

had more than one error type, Type 1 (BB) was also dominant. Thirty-one subjects (96.88%) had at least one BB error. As well, 12 subjects (37.50%) had only BB errors, ranging from one to six.

The results of this pronunciation test confirmed that incorporating the base-word vowel and stress pattern (or BB) in the pronunciation of derivatives was a significantly dominant pronunciation strategy for both ESL and NS subjects. Cutler's (1981) study of native speakers of English has found evidence of the strategy of stressing a base word on the syllable which bears stress in the derivative form, as in [mˈədʒˈɛsti] ~ [məˈdʒɛstɪk] for *majesty* ~ *majestic*. This was referred to as "reverse strategy". In our study, reverse strategy was relatively infrequent, found only in 16 out of the 60 word pairs, and a total of 75 pairs (7.43%) for the ESL group. They also made up 16.70% cent of all BB errors. Reverse strategy was also not common among the NS subjects, making up only 3.45% of all BB errors for this group. Only two NS subjects had reverse strategy error in one word pair, *majesty* ~ *majestic*. According to Cutler (1981), a possible explanation is that in the process of vocabulary acquisition, speakers acquire the derived forms before the base-word forms and pronounce the base words according to the base-word portions of the derivatives.

For the pronunciation test as a whole, the dominance of BB errors in the pronunciation of derivatives was found to be statistically significant for the ESL group, representing 44.50% of the group's pronunciation errors. Moreover, 90.63 % cent of the ESL subjects and 60.00% of the 60 word pairs had BB as the main error type. Therefore, the results of the pronunciation test for the ESL group as a whole showed that BB pronunciation was the dominant error type in the production of Latinate derivatives. Therefore, Hypothesis 2 was confirmed. Among the ESL subjects, the dominant error type in the pronunciation of derivatives was the incorporation of base-word vowel and stress pattern rather than any other types of errors. The dominance of this error type was found to be statistically significant for both the ESL group and the NS group.

While a number of the ESL subjects' productions involved either base-word vowel or base-word stress, the former (Types 2 (B$\surd$) and 4 (BX)) constituted 21.71% of errors, while the latter (Type 3 (XB)) made up only 1.59% of errors. Thus, contrary to Baptista (1989), errors incorporating base-word vowels (totaling 66.21%) were more frequent than those incorporating base-word stress (46.09%). This was also true for NS subjects, Types 2 and 4 being 20.24% vs. 1.19% for Type 3.

Sometimes, the ESL subjects produced the correct vowels, but placed the primary stress on the wrong syllable (Type 6 ($\surd$X)), but this constituted only 4.96 per cent of errors. The initial syllable was given primary stress instead of secondary stress, as in [ˈdɛkləreʃɳ]. This error occurred randomly among the NS subjects, constituting only 3.57% of errors. It was interesting to note that where the ESL subjects favoured correct vowel alternations with incorrect

primary stress placement ([+vowel, −stress], 31.51%) in the perception task, their production of correct vowels with incorrect stress pattern was much lower (Type 6 ($\surd$X), 4.96%). While this confirmed their ability to aurally recognize the need for vowel reduction in unstressed syllables, the prevalence of unreduced vowels in unstressed syllables affected their production.

On the whole, non-BB errors in pronunciation showed that the ESL subjects were beginning to make vowel and stress shifts in derivatives, producing words that had different vowel and stress patterns from their base words. The second most frequent error type for the ESL group was XX (Type 7, 19.52%), closely followed by BX (Type 4, 19.43%). That the ESL subjects were shifting the primary stress from the base word to a syllable in the suffix was also noteworthy, but in their production of some of these words, they failed to make vowel reductions, as in [ˌprokleˈmeʃn̩]. Interestingly, errors in the production of some derivatives found among the NS subjects, such as *comparable*, *recitation*, *admiration* and *telegraphy*, showed that vowel and stress shifts in derivatives were not natural, as confirmed in earlier L1 studies.

The results indicated that for the ESL group and the NS group, base-word vowel and stress pattern was the dominant error type in the pronunciation of Latinate derivatives. This confirmed that the ESL subjects, having no analogous vowel and stress shifts between morphologically related words in their L1, showed the same pattern of simplification in their pronunciation of derivatives as NS subjects, presumably based on reasoning by analogy with Anglo-Saxon derivatives.

Semantic rating of word pairs test

Of the 60 word pairs in the semantic rating of word pairs test (taken from the pronunciation test), seven of the word pairs were not rated by the ESL group, and only one word pair was not rated by the NS group (see Appendix). In the following discussion, the abbreviation MSR refers to the "mean semantic rating" for each word pair by a group of subjects.

Table 4 shows the results of the semantic rating of word pairs test. The MSR for all the 60 word pairs in the semantic rating of word pairs test was generally lower for the ESL group than that for the NS group, at 3.9 and 4.1 respectively. The ESL group had lower MSR than the NS group for 41 out of the 60 word pairs, but the difference in the MSR between the groups for the 60 word pairs was not statistically significant (t(df 118) = 0.638 n.s.).

Of these 60 pairs, 35 contained obvious-suffix derivatives (e.g. *similar* ∼ *similarity*). The base words were preserved in the spelling of the derivatives, including those which had orthographic changes that followed the same rule in Anglo-Saxon derivatives, that is, word-final '*y*' becomes '*i*' before a suffix. For the 35 word pairs containing obvious-suffix derivatives, the MSR was 3.6 for the ESL group and 3.8 for NS group. A *t*-test showed that this difference was not

Table 4: ESL and NS subjects: Results of mean semantic rating (MSR) of word pairs test

MSR values for:	ESL group	NS group	*t*
– 60 word pairs	3.9	4.1	(df 118) = 0.638 n.s.
– 35 word pairs with obvious -suffix derivatives	3.6	3.8	(df 68) = 1.840 n.s.
– 30 word pairs with obvious -suffix derivatives and transparent meaning associations	4.2	4.4	(df 58) = 0.075 n.s.
– 5 word pairs with obvious -suffix derivatives and opaque meaning associations	2.4	2.9	N/A
– 25 word pairs with non-obvious -suffix derivatives	4.2	4.4	(df 48) = 1.49 n.s.

statistically significant (t (68) = −1.840 n.s.). The 35 word pairs that contained obvious-suffix derivatives were further analyzed according to the participants' ratings for opaque or transparent semantic relations, an MSR of 3 (mid-point) and below being taken as the criterion for opaque semantic relations. Five pairs were rated as semantically opaque by the ESL subjects (called Type A). They were *author* ∼ *authority, origin* ∼ *aborigines, family* ∼ *familiar, minor* ∼ *minority*, and *element* ∼ *elementary*. For these five pairs, the MSR was 2.4 for ESL subjects and 2.9 for NS subjects. (Because of the small number of word pairs, a *t*-test was not performed.) Only the first three of these pairs were also rated as opaque by the NS subjects. For the remaining 30 word pairs that contained obvious-suffix derivatives and were rated as semantically transparent by the ESL subjects (called Type B), the MSR of the ESL group was also lower than that of the NS group (4.2 vs. 4.4). The MSR of 22 word pairs was lower for the ESL group than the NS group. Therefore, the ESL group had lower MSRs than the NS group for word pairs with obvious-suffix derivatives that had opaque semantic relations as well as those that had transparent semantic relations. However, the *t*-test performed on the MSRs of the 30 word pairs with obvious-suffix derivatives and transparent semantic relations (Type B) showed that there was again no statistically significant difference between the two groups (t(58) = 0.075 n.s.).

Of the 60 word pairs in the semantic rating test, 25 pairs had non-obvious-suffix derivatives (eg. *prepare* ∼ *preparation*). For these 25 word pairs, the difference in MSR between the two groups was also not pronounced, being 4.2 and 4.4 for the ESL group and the NS group respectively. The *t*-test showed that this difference between the groups was not statistically significant (t(48) = −1.49 n.s.). Therefore, the ESL subjects had lower MSRs than the NS subjects for word pairs containing obvious-suffix derivatives as well as derivatives

containing non-obvious suffixes, with no statistically significant differences between the two groups. This confirmed that the awareness of the semantic relatedness between morphologically related words for the two groups was comparable.

We may conclude that for the ESL subjects, awareness of the semantic relations between the morphologically related words in the word pairs was indeed a factor in their preference for base-word vowel and stress pattern in the phonological representations of Latinate derivatives. Thus, Hypothesis 3 was confirmed. The incorporation of base-word pronunciation in the aural recognition and oral production of Latinate derivatives is based on the learners' and native speakers' perceived semantic relatedness between morphologically related words.

The word pair that had high semantic recognition and high BB among the ESL subjects was *photograph* ~ *photographer*. The MSR was 4.6 and BB was 70.83%. However, a lower recognition of the semantic relations between two morphologically related words did not prevent ESL subjects from incorporating base word vowel and stress pattern in their phonological representations of derivatives. For example, while the MSR for *invent* ~ *inventory* was 3.7, BB was 75.00% in listening and 100.00% in pronunciation. This BB pronunciation could be triggered by the spelling similarity found in the word pair. However, low MSR accompanied by high BB among ESL subjects was found for only two word pairs with opaque semantic relations *(invent* ~ *inventory* and *author* ~ *authority*.) On the other hand, a high MSR did not always lead to a high BB pronunciation. This could be explained by the learners' greater familiarity with the pronunciation of the word pair, which was in turn due to the high frequency of the derivatives. This was found for only two word pairs, *Japan* ~ *Japanese* and *element* ~ *elementary* (as in "elementary school"). On the whole, the data seemed to suggest that, generally, for the ESL group, meaning relatedness between base words and derivatives was used as a cue for the phonological representations of derivatives.

In Stemberger's (1995) model of language production, lexical access is relevant to the pronunciation of morphologically complex words because accurate production is possible only when lexical access proceeds successfully. Thus, an error in word production that contains the stress and vowel patterns of a derivationally related word is caused by the shared representation of the words in the speaker's lexicon. For the ESL subjects, the shared representation appeared to be the semantic representation, leading to errors in the production of derivatives.

Pedagogical implications

Contrary to earlier research findings, this study showed that for Cantonese ESL learners, problems with the pronunciation of derivatives were due to not only errors of phonology alone, but also errors of morphophonemics. The errors were due to the strategy of simplification of pronunciation rules for Latinate derivatives, also found among native speakers. This simplification could be the result of the application of the strategy of analogy (between Anglo-Saxon and Latinate derivatives) and ease of analysis (minimize phonological changes). The results also confirmed that in a single-word context, the correct aural recognition of derivatives by learners is higher than the oral production of the same derivatives. Learners' aural recognition of derivatives in continuous speech stream also needs to be examined. Practicing the pronunciation of base words and associated derivatives would have to continue into the advanced stages of language learning.

Conclusion

The listening, pronunciation, and semantic rating tests confirmed that base-word pronunciation was the dominant error in Cantonese ESL learners' phonological representations of Latinate derivatives, and that the learners' perception of the semantic relations between base words and derivatives prompted the error. Going beyond the traditional emphasis on L1 transfer and on segments, word prosody and syllable structure, we have proposed semantic associations between morphologically related words as a factor that could influence learners' errors in the pronunciation of derivatives. In doing so, we have also shown the semantic association between base words and derivatives in the learners' lexicons, a linguistic awareness that comes with L2 word acquisition experience. We have confirmed that ESL learners whose L1, Cantonese, has no analogous derivative morphology and related morphophonemic features, rely on the same learning strategies as native speakers of the language, that is, simplification and reasoning by analogy with simpler Anglo-Saxon derivatives. These findings may be generalizable to other learners whose L1s lack derivational affixation and morphophonemic rules related to such affixation. Comparison between ESL learners whose L1s are typologically different is warranted.

Notes

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[1] In our phonetic transcription of target words, the syllable receiving primary stress is marked with ˈ and the syllable receiving secondary stress is marked with ˌ (as in [ˌprɑsˈpɜrəti] for "prosperity").

[2] Due to space constraints, phonetic transcriptions of the listening test items are not included here

[3] Ninety-five word pairs were used in the semantic rating of word pairs test in the original Ph.D. dissertation for the word analysis test. Due to space constraints, only the 60 word pairs used to analyze semantic rating in relation to the pronunciation test are included here.

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Appendix:
Semantic Rating of Word Pairs Test

Name: . . . . . .

Instructions:

There are 95 pairs of words below. Rate how closely each pair of words are RELATED IN MEANING, using the range of 1 to 5.

1. Circle 1 if a pair of words are DEFINITELY NOT RELATED IN MEANING.
2. Circle 5 if a pair of words are DEFINITELY RELATED IN MEANING.
3. Circle 3 if a pair of words are SOMEWHAT RELATED IN MEANING.
4. Circle 4 if a pair of words are MORE THAN SOMEWHAT RELATED IN MEANING BUT NOT DEFINITELY RELATED IN MEANING.
5. Circle 2 if a pair of words are LESS THAN SOMEWHAT RELATED IN MEANING BUT NOT DEFINITELY UNRELATED IN MEANING.

	Word Pair	1 Definitely not related in meaning	2	3	4	5 Definitely related in meaning
1.	combine-combination	1	2	3	4	5
2.	author-authority	1	2	3	4	5
3.	explain -explanation	1	2	3	4	5
4.	politics-political	1	2	3	4	5
5.	vary-variety	1	2	3	4	5
6.	recite-recitation	1	2	3	4	4
7.	Christian-Christianity	1	2	3	4	5
8.	biology-biological	1	2	3	4	5
9.	formal-formality	1	2	3	4	5
10.	refer-references	1	2	3	4	5
11.	prosper-prosperity	1	2	3	4	5
12.	mechanic-mechanism	1	2	3	4	5
13.	prepare-preparation	1	2	3	4	5
14.	confident-confidential	1	2	3	4	5
15.	grammar-grammatical	1	2	3	4	5
16.	influence-influential	1	2	3	4	5

17.	major-majority	1	2	3	4	5
18.	desperate-desperation	1	2	3	4	5
19.	magnet-magnetic	1	2	3	4	5
20.	national-nationality	1	2	3	4	5
21.	reserve-reservation	1	2	3	4	5
22.	continent-continental	1	2	3	4	5
23.	explore-exploration	1	2	3	4	5
24.	origin-aborigines	1	2	3	4	5
25.	popular-popularity	1	2	3	4	5
26.	invent-inventory	1	2	3	4	5
27.	declare-declaration	1	2	3	4	5
28.	compare-comparable	1	2	3	4	5
29.	accident-accidental	1	2	3	4	5
30.	element-elementary	1	2	3	4	5
31.	similar-similarity	1	2	3	4	5
32.	incline-inclination	1	2	3	4	5
33.	economy-economical	1	2	3	4	5
34.	history-historical	1	2	3	4	5
35.	commerce-commercial	1	2	3	4	5
36.	compose-composition	1	2	3	4	5
37.	resign-resignation	1	2	3	4	5
38.	minor-minority	1	2	3	4	5
39.	revolve-revolution	1	2	3	4	5
40.	exclaim-exclamation	1	2	3	4	5
41.	metal-metallic	1	2	3	4	5
42.	admire-admiration	1	2	3	4	5
43.	stable-stability	1	2	3	4	5
44.	comedy-comedian	1	2	3	4	5
45.	compete-competition	1	2	3	4	5
46.	majesty-majestic	1	2	3	4	5
47.	photograph-photographer	1	2	3	4	5
48.	colony-colonial	1	2	3	4	5

49.	Japan-Japanese	1	2	3	4	5
50.	hospital-hospitality	1	2	3	4	5
51.	telegraph-telegraphy	1	2	3	4	5
52.	revolt-revolution	1	2	3	4	5
53.	valid-validity	1	2	3	4	5
54.	perspire-perspiration	1	2	3	4	5
55.	prior-priority	1	2	3	4	5
56.	magic-magician	1	2	3	4	5
57.	proclaim-proclamation	1	2	3	4	5
58.	democrat-democratic	1	2	3	4	5
59.	industry-industrial	1	2	3	4	5
60.	family-familiar	1	2	3	4	5