

INDIVIDUAL DIFFERENCES IN SECOND-LANGUAGE ABILITY: A FACTOR-ANALYTIC STUDY*

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The second-language abilities of 51 English speakers learning Dutch naturalistically were tested at three points during their first year in the second-language environment. The tests used reflected abilities in pronunciation, auditory discrimination, morphology, syntax, vocabulary, comprehension of running speech, fluency, and metalinguistic judgments. Factor analyses of the results revealed the emergence during the year of two major second language factors: grammar plus vocabulary and phonological ability. The vocabulary tests correlated highly with tests of syntax and morphology at all test sessions. These results are related to hypotheses concerning individual differences in strategies of first- and second-language acquisition.

A question of considerable theoretical and practical importance is whether individual differences exist in language ability. Can the ability to learn or use a language be analyzed into component abilities, and if so, do different people possess these component abilities in different patterns? Although research relevant to this problem has been carried out on second-language learners (see, for example, Carroll, 1958; Gardner and Lambert, 1965; Pimsleur, 1963), almost all of the research aimed at discovering components of language learning ability has been based on formally taught second languages. It is very possible that the results of such studies reflect components of educability as much as components of language ability.

In the current study, a factor analysis of second-language achievement scores was carried out on data from subjects who were acquiring a second language naturally, with no formal training. Furthermore, longitudinal data were available from the subjects, so components of second-language ability at different levels of second-language achievement could be identified.

PROCEDURE

Subjects

English speakers living in the Netherlands were recruited to take part in the study through schools and social organizations. The subjects, who were tested three times at

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4–5 month intervals, had arrived in Holland within six months prior to the first test session, and most had started learning Dutch only at the beginning of the school year, 4–6 weeks prior to the first session (see Snow and Hoefnagel-Höhle, 1978, for more details concerning the subjects). The criterion for inclusion in the study was that the subjects were learning Dutch naturally, from contacts with schoolmates, colleagues at work, neighbors, etc., without significant amounts of formal instruction. The primary exposure to Dutch for the 3–15-year-olds in the study came from school (all were attending ordinary Dutch schools for six hours a day), with some additional exposure through playing with friends outside school time. The five adult males were all working full-time in Dutch-language environments, in which, however, it was also possible to use English with colleagues, since most Dutch adults have a fair command of English. The six adult women's primary exposure to Dutch came from shopping, social interactions with neighbors, and contacts with children's schools, government offices, etc. Most of the subjects continued to use English as the primary language in the home throughout the period covered by this research, although in a few families with several children attending Dutch schools, Dutch was sometimes used among family members.

The subjects were selected to represent the entire age range, and were distributed fairly equally across the range three years to adult (19 3–7-year-olds, 22 8–15-year-olds, and 11 adults). There was some attrition in the course of the year; 47 subjects participated in session 1, 37 in session 2, and 33 in session 3. A few subjects did not complete all the tests, leading to slight variability in the actual numbers reported on for the various tests.

Testing

The subjects were tested individually at school or at home, in a relaxed session lasting about 1½ hours. Ten tests were included in the test battery, resulting in 14 different scores per subject. Three of these scores reflected first-language skill (the English PPVT, English Category-naming, and English Fluency). The Dutch achievement tests were selected to give as complete a picture as possible of productive and receptive control of Dutch phonology, morphology, syntax, and vocabulary, as well as an indication of the subject's ability to produce and understand running speech.

Pronunciation test. In order to assess productive control of Dutch phonology, the subjects were asked to pronounce 80 words in each of two conditions: immediately after hearing a native speaker say the word (Imitation) and a few minutes later, with no immediate auditory model (Spontaneous). The words were elicited by means of pictures, and were selected to present initial /r/, initial and final consonant clusters, and all vowels and diphthongs in various consonantal contexts. The results were scored per word on a six-point scale (0 = English word; 1 = uninterpretable as target word; 3 = target word pronounced with noticeable accent; 5 = indistinguishable from a native speaker) by a native speaker of Dutch. Rescoring of the subjects several months later produced 89% agreement with the original scores. The subject's score was a mean of all individual word scores per condition.

Auditory discrimination. Receptive control of Dutch phonemic distinctions not made in English was tested by asking subjects to point to the correct one of several pictures

after auditory presentation of a word. Both words of a minimal pair were presented, all words selected to be familiar and picturable (e.g., *man* /mɒn/ 'man' and *maan* /man/ 'moon'). The order of presentation was random. Fifty-six items were presented, testing 14 oppositions. As the results were affected by knowledge of the vocabulary items, the subjects' scores were computed by taking the ratio of auditory confusions to correct responses plus auditory confusions, ignoring irrelevant responses (e.g., 'moon' for 'kitchen'). A low score thus indicates good performance on this test.

Sentence repetition. Thirty-seven Dutch sentences of increasing length and grammatical complexity were read one-by-one to the subjects, who were asked to repeat them. The grammatical structures tested progressed from simple subject-verb sentences to sentences with relative clauses and temporal adverbial clauses. Several of the sentences included prepositional constructions which a contrastive analysis suggested would present particular difficulties to English speakers. Vocabulary was kept simple in all the sentences, so that the results could be interpreted primarily as relevant to control of syntax. A subject's score was the number of words correctly produced (maximum = 238).

Sentence judgment. Fourteen pairs of sentences were read to the subjects. In each case, one was a correct and one an incorrect rendering of the same content. The subjects were asked to say which sentence was better. Subjects' scores are given as the number of incorrect answers, i.e., a low score indicates good performance. The sentences presented for judgment were all short and simple. The structures tested included word order in subordinate clauses and use of the correct preposition after certain verbs and in locative constructions. The test was completed with a mean of 0.1 errors by eight 12-year-old native speakers of Dutch, and with a mean of 3.2 errors by eight 6–7-year-old native speakers.

Story comprehension. A simple, tape-recorded story in Dutch was played to the subjects, who were then asked to retell the story in English (or Dutch if they preferred). Comprehension was scored on the basis of recalling 30 key points in the story.

Sentence translation. Sixty sentences of increasing length and grammatical complexity were given in English, and the subjects were asked to translate them. Any necessary help was given with lexical items, as the test was designed to reflect control of syntax. The same grammatical constructions included in the sentence-repetition and sentence-judgment tasks were incorporated into the sentence-translation test. Subjects' responses were scored by giving a point for each grammatical structure correctly produced (e.g., verb, auxiliary verb, adverb, prepositional phrase, indirect object) and for correct word order in each clause (maximum = 325).

Morphology. Berko's (1958) "wug-test" procedure was used to test for control of the morphological rules for formation of plural, diminutive, agentive, past tense, and past participle, as well as for final devoicing when producing the singular form of a word presented in the plural. The subjects were given real words and asked to produce the appropriate form (e.g., *If you have one boy, then you have two —?*). Pictures were used for the younger children. After the task was explained with real words, nonsense words were introduced as the test items. The subject's score was the number of correct responses (maximum = 82).

Story-telling. In order to elicit spontaneous speech, subjects were asked to tell a story

TABLE 1

Rotated Factor Matrix for Time 1

Variable	Vocabulary	Dutch Productive Ability	English Fluency
Imitative pronunciation	0.08	0.83	0.06
Spontaneous pronunciation	0.30	0.74	0.01
Auditory discrimination	-0.38	-0.52	0.57
Sentence repetition	0.56	0.78	-0.03
Sentence judgment	-0.57	-0.45	0.00
Story comprehension	0.38	0.72	0.12
Sentence translation	0.63	0.75	-0.01
Morphology	0.78	0.48	0.13
English PPVT	0.95	0.16	0.09
Dutch PPVT	0.83	0.40	0.13
English fluency	0.42	0.33	0.80
Dutch fluency	0.15	0.86	0.01
English category-naming	0.84	0.10	0.13
Dutch category-naming	0.84	0.35	-0.20

on the basis of a set of pictures provided. This was done both in Dutch and in English. A fluency score was calculated by taking the ratio of number of words to number of seconds engaged in telling the story.

Peabody Picture Vocabulary Test (PPVT). A version of the PPVT standardized for Dutch up to age 8 was administered (Manschot and Bonnema, 1974). This is a passive vocabulary test, in which the subject points to the correct one of four pictures after the experimenter says a word. The PPVT was also administered in English at the first test session, and scored according to the scoring manual in English.

Category-naming. As a supplement to the PPVT, which is a passive test of vocabulary, the subjects' productive vocabulary was tested by having them name as many items as possible within a certain category — animals or fruits and vegetables — in one minute. The number of items correctly produced, minus repetitions, was taken as the subject's score. Category-naming was done both in Dutch and in English.

RESULTS

The scores for the three test sessions were submitted to separate factor analyses. Missing data were pair-wise deleted in the calculation of the correlation matrices. Factors were extracted by principal factoring with iteration. All factors with an eigenvalue greater than or equal to 1.00 were extracted. The maximum off-diagonal element of the correlation matrix was used as the initial estimate of communality. A varimax rotation after Kaiser normalization was applied.

The relatively small number of subjects on which the factor analysis is based requires that the results obtained here be treated as hypotheses rather than as firm conclusions, and that confirmatory factor analyses on other populations of subjects learning a second language naturally, be performed.

The rotated factor matrix for the first test session is given in Table 1. Factor loadings above 0.40 are taken to be significant, and those above 0.65 as central to the interpretation of the factor. The first factor, which after rotation explained 76.2% of the variance, seems to be primarily a vocabulary factor; both English and Dutch vocabulary tests loaded very highly. Sentence repetition, sentence translation, morphology, and English fluency also loaded significantly. Performance on these three tests of Dutch ability depends on at least a minimal knowledge of Dutch vocabulary, so it is not surprising that they should correlate with the vocabulary tests. The second factor might be called Dutch Productive Ability, since both pronunciation tests, sentence repetition, sentence translation, and Dutch fluency loaded very highly. Story comprehension, however, also loaded centrally on this factor, and all the other tests of Dutch language ability except category-naming loaded significantly, suggesting that no clear distinction can be made between productive and receptive ability at this early stage of second-language acquisition. The third factor is a fairly specific factor for English fluency, on which auditory discrimination also loaded significantly. The positive loading for auditory discrimination indicated that high scores on English fluency were associated with a poor ability to discriminate minimal pairs in Dutch. The fact that several variables loaded significantly on

TABLE 2
Rotated Factor Matrix for Time 2

Variable	Vocabulary	Dutch Receptive Ability	Pronunciation
Imitative pronunciation	0.08	0.12	0.99
Spontaneous pronunciation	0.14	0.32	0.89
Auditory discrimination	-0.05	-0.54	-0.12
Sentence repetition	0.41	0.66	0.36
Sentence judgment	-0.64	-0.27	-0.17
Story comprehension	0.43	0.78	0.08
Sentence translation	0.66	0.51	0.30
Morphology	0.79	0.53	0.10
English PPVT	0.96	-0.07	-0.02
Dutch PPVT	0.87	0.37	0.05
English fluency	0.46	0.54	-0.00
Dutch fluency	0.06	0.72	0.42
English category-naming	0.72	0.11	0.10
Dutch category-naming	0.61	0.52	0.19

both factors 1 and 2 indicates an indistinct factor structure at time 1. If there are clearly separable components of second-language ability, they are not yet identifiable during the first stages of second-language acquisition.

The results for session 2 (see Table 2) produced factors which are somewhat more distinct. Factor 1, which after rotation explains 70.5% of the variance, seems to be primarily a vocabulary factor, since both Dutch and English PPVT and category-naming load very highly; in addition, sentence judgment and sentence translation load relatively highly, and English fluency, moderately highly. The second factor, which might be called Dutch Receptive Ability, is defined primarily by story comprehension and auditory discrimination. However, Dutch fluency also loads very highly, sentence repetition, quite highly, and sentence translation and morphology, moderately highly, suggesting that receptive and productive abilities at this level of proficiency still cannot be clearly separated from one another. Both contribute to variance on the tests of grammatical ability. The third factor is quite clear and independent of the first two; it consists of both pronunciation scores, and must be called Pronunciation.

The results for session 3 show both a distinct and an interpretable factor structure (see Table 3). Factor 1, which explains 65.2% of the variance after rotation, consists of all the tests of grammar and vocabulary. Factor 2 consists primarily of the tests of phonological ability. It is defined by the two pronunciation scores and auditory discrimination. Their presence in the same factor confirms that, after a certain level of proficiency is reached, correctness of pronunciation is limited by the ability to make fine auditory discriminations. The fact that Dutch fluency loads highly on this factor suggests that the ability to speak fluently is related to pronunciation ability. The third factor at time 3 consists only of English fluency, which by time 3 no longer shows any relation to skill at speaking or understanding Dutch.

DISCUSSION

The results suggest that there are separate components of second-language ability: control of grammatical skills and control of phonological skills. These two components become obvious only after speakers have achieved a fairly good control of their second language. (The subjects tested here were almost all functioning fairly well as bilinguals in Dutch school and work situations by the third test session.) It is interesting to note how these two components separate themselves out through time. At the first test session, pronunciation loaded on the same factor as several of the grammatical abilities tests, whereas auditory discrimination loaded on a different factor. At time 2, the various grammatical abilities tests showed a relationship both to vocabulary skills and to receptive skills. Pronunciation had been separated out as a factor, but auditory discrimination still clustered with vocabulary and with some of the grammatical abilities tests. At this stage of proficiency, the correlation between pronunciation and auditory discrimination was still very low, suggesting that differences in pronunciation ability might have been the result of motor rather than perceptual deficits. By time 3, pronunciation and auditory discrimination correlated highly and formed one factor, suggesting that perceptual ability

TABLE 3
Rotated Factor Matrix for Time 3

Variable	Vocabulary and Grammar	Phonological Ability	English Fluency
Imitative pronunciation	0.10	0.80	0.27
Spontaneous pronunciation	0.10	0.96	0.07
Auditory discrimination	-0.23	-0.69	0.28
Sentence repetition	0.63	0.61	-0.05
Sentence judgment	-0.73	-0.42	0.25
Story comprehension	0.70	0.42	0.16
Sentence translation	0.76	0.44	0.26
Morphology	0.78	0.36	0.07
English PPVT	0.72	-0.34	0.32
Dutch PPVT	0.85	0.03	0.21
English fluency	0.22	0.13	0.98
Dutch fluency	0.21	0.73	0.08
English category-naming	0.67	0.05	0.48
Dutch category-naming	0.76	0.26	-0.02

had become the limiting factor in pronunciation skill. This finding lends support to the suggestion (Weiss, 1976) that ear training is as effective in improving one's foreign language pronunciation as articulation training. At time 3, grammatical abilities and phonological abilities formed two clearly separate factors, neither of which correlated with English fluency, though Dutch grammatical ability did correlate with the English vocabulary tests.

At all test sessions, knowledge of Dutch vocabulary was closely related to control of Dutch morphology and syntax. This finding can be explained in several ways:

1. Vocabulary learning and grammar acquisition are two separate processes based on different abilities, which happen to correlate.
2. Vocabulary acquisition is promoted by a good control of morphology and syntax, since morphological and syntactic information makes it possible to figure out the meaning of the words encountered.
3. Morphological and syntactic information is acquired first as ways of using specific words. The more words one knows, the faster generalizations about morphological and syntactic processes can be formed. Thus, reaching a level of control which allows for productive use of morphological and syntactic rules depends on having acquired a large vocabulary. In first-language acquisition, it seems to be the case that a certain minimum vocabulary must be achieved before any morphology or syntax is introduced, suggesting that the third explanation is correct for at least the first stages of primary language acquisition. Felix (1978), however, has suggested that first- and second-language acquisition differ precisely in that second-language learners apply syntactic principles before their experience with the second language is adequate to allow for syntactic generalizations. He gives examples from two English speakers learning German, who produced large numbers of sentences in which the copula was used to express all possible semantic relations between NP's, e.g. *Was ist du?* meaning 'What are you doing?'. Felix argues that such utterances result from applying syntactic knowledge ("sentences have verbs") without knowledge of second-language vocabulary or structure. The fact that both of Felix's subjects produced these deviant utterances might indicate that they were influenced by one another (they were brother and sister), rather than that this is a universal type of error in second-language acquisition. Hatch (1974) presents data suggesting that there are at least two types of second-language learners: data gatherers, who imitate a great deal and use a mixture of correct and incorrect forms, and rule learners, who show much more orderly stages of acquisition with little variability of forms produced during any stage. It may be that the rule learners operate more according to the second explanation given above and the data gatherers more according to the third.

The conclusion that grammatical ability and phonological ability represent two stable components of second-language skill rests on the assumption that these two factors would indeed be found for more advanced second-language speakers than those tested here. Although not enough subjects were available six months after the third test session to

be able to do a factor analysis on a fourth test session, we do have scores from 11 of the subjects about one-and-a-half years after they started learning Dutch. Inspection of those scores suggests that the two factors still account for the data very satisfactorily. Individual differences were especially striking in the degree to which subjects had mastered perfect pronunciation and auditory discrimination. This mastery was quite independent of their scores on the tests of grammatical ability. For example, one seven-year-old who scored relatively high on all the tests of grammatical ability showed little or no improvement after the second test session in pronunciation. One teenager achieved near perfect pronunciation by the third test session, but continued to score considerably below the mean on morphology and sentence judgment. These individual differences at time 4 suggest that the two major components of second-language ability identified at time 3 subsequently remain relatively stable. This conclusion also accords with experience; everyone knows some foreigners who speak their second language very correctly but for a striking accent, or alternately, who continue to make serious syntactic and morphological errors despite sounding very much like native speakers in simple conversations.

The factors of second-language ability which emerged from this study cannot be related directly to the second-language ability factors found by Carroll (1958), which included Linguistic Interest, Associated Memory, Sound-Symbol Association, Inductive Language Learning Ability, and Grammatical Sensitivity. As suggested above, however, Carroll's factors may be specific to formally acquired second languages. Pimsleur, Sundland and McIntyre (1964) reported that the major difference between over- and under-achievers in second-language classes was on auditory ability, as measured by the Chinese Pitch Test and the Sound-Symbol Test. This finding, again, accords only partially with our results, which suggest that some second-language learners will be limited primarily by their auditory abilities, but others primarily by their ability to acquire syntactic and morphological rules. It may be that the auditory ability plays a more central role in audio-lingual second-language classrooms, and that variance on both abilities emerges only in a more natural second-language learning situation, in which both aural and written input are available to the learner. The fact that even very young second-language learners varied on the factors Vocabulary and Grammar versus Phonological Ability suggests strongly that the same two component abilities may also be identifiable for first-language acquisition.

Very little attention has been paid to the question of individual differences in first language ability, since it is often assumed that all native speakers are equivalent in possessing full competence in their native language (Chomsky, 1965; Lenneberg, 1967). Nonetheless, such individual differences do exist in phonological abilities (Moscowitz, 1973) and grammatical abilities (Gleitman and Gleitman, 1970), as well, of course, as in vocabulary, fluency and facility. Furthermore, increasing amounts of evidence suggest that there are important individual differences in the patterning of acquisition among first-language learners. For example, of the three children Adam, Eve and Sarah studied by Cazden (1968), Sarah was, at a certain point in development (as measured by mean length of utterance), much farther along in the acquisition of morphology than the other children. Bloom, Lightbown and Hood (1975) found different approaches to the acquisition of syntax: "analytic" children who used many different nouns to express

semantic categories in their two- and three-word utterances, and "synthetic" children, who encoded a semantic category as a constant form using adverbs and pronouns as if they were affixes of the verb. This distinction was not directly related to the tendency of the children to learn by imitation of adult utterances (Bloom *et al.*, 1974), though there were also large individual differences in this regard. Willingness to imitate may be negatively related to a tendency to acquire phonological rules in an orderly way (Macken, 1976), if children who choose to imitate a lot and to acquire a large vocabulary find it harder to submit the large amounts of data accumulated to any simple rule system. Nelson (1973) identified two types of children on the basis of their early vocabulary acquisition: referential children, who learned relatively many common nouns, and expressive children, who learned relatively more words having a social or expressive function.

As mentioned above, Hatch (1974) has suggested the dichotomy rule learner and data gatherer explains observed differences in the course of naturalistic second-language acquisition. Although these different strategies of acquisition cannot be related directly to the distinction which emerged from the factor analyses of grammatical ability versus phonological ability, one might hypothesize that "data gathers" and "imitators" are relatively strong in phonological ability and relatively weak in grammatical ability. A potential integration of the various notions about individual differences in language learning ability would require a research strategy in which information about both the process of acquisition (the nature of the strategies being used by the child) and the product of acquisition (what the child knew at any given time) was available. This would involve combining data about spontaneous speech in free interaction situations with results from tests of different language skills. It may well be that administering a test battery such as that used in this study to a group of native speakers would lead to evidence that there are individual differences in grammatical and phonological ability among native speakers as well as among second-language speakers. Such a finding would help to make explicit the ways in which first- and second-language acquisition are similar to one another, and would contribute to an understanding of the recent findings that similar errors are made by first- and second-language learners (Dulay and Burt, 1974; Ervin-Tripp, 1975; Hatch, 1974; Macnamara, 1975; Ravem, 1968; Snow, 1976).

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