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FOREIGN LANGUAGE LEARNING ABILITY[1]

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This report on 2 studies of factors involved in learning French is based on 23 tests administered to 208 students in college French, and on 22 tests administered to 202 additional students a year later. The factors extracted and rotated in each study included: Verbal, Reasoning, Speed of Articulation, Pitch Discrimination, Timbre Discrimination, Interest, and Biographic. Multiple correlation test selection analyses resulted in (a) R = .65, using 6 tests to predict Cooperative French Test scores; (b) R = .41, using 5 tests to predict aural comprehension; and (c) R = .41, using 5 tests to predict speaking proficiency. Verbal IQ and Interest (motivation) appear to be the most important factors in college foreign language learning; Reasoning, Word Fluency, and Pitch Discrimination also contribute.

It is popularly believed that foreign languages are analogous to mathematics or music in that a special talent is required to learn any of them. This belief appears fallacious and even harmful in that it may adversely affect the achievement of those who think that they do not possess this special talent. The investigation of which this paper is a part seeks to reduce the so-called "talent for languages" to a set of well-defined, measurable components. Tests of the components will then be used to predict probable success in foreign language courses. The attempt to isolate and describe as many as possible of the components affecting foreign language learning should lead to improved understanding of the learning processes involved. Presumably, the tests developed for predictive purposes will also be found useful in diagnosing the sorts of difficulties encountered by poor language learners.

As Carroll's (1960) thorough review of the literature of foreign language prognosis indicates, considerable success has been achieved in predicting results of intensive language courses, such as those given in the military services. However, attempts to predict achievement in high school and college courses have generally been less successful. There appear to be influences present in the typical school course which do not enter into intensive courses, and which need to be taken into account to attain high predictive validity. Prognostic tests composed entirely of intellectual tasks probably owe their rather low validity to their failure to include important nonintellectual variables. Motivation factors almost certainly affect achievement, and personality may also be important. Another kind of prognostic test, the work sample, sometimes is a good predictive device, but sheds no light on the language learning process. The studies reported in this paper attempt to deal with a number of fairly precise intellectual and motivational factors. Personality factors, not included here, will be introduced in subsequent research. The previous research most closely related to that reported here is the work of Carroll (1958).

The two studies which are the subject

[1]Since June 1960, the research reported herein has been performed pursuant to a contract with the Office of Education, United States Department of Health, Education, and Welfare.

of this paper were conducted at UCLA in the spring semesters of 1958 and 1959, respectively. In both cases, the subjects were students in second semester French courses, 208 in the first study, and 202 in the second. The two samples appear closely comparable, and quite typical of a moderately good group of American undergraduates. Their average age was 19 years; most were graduates of California public high schools who gained admission to college by achieving a B average; most were taking French to fulfill degree requirements.

The data consist of scores on a number of predictor variables and several criteria. In the light of the current shift toward teaching the spoken language, it was of particular interest to attempt differential prediction of traditional (grammar-reading) achievement on the one hand, and oral-aural achievement on the other.

All tests were administered to groups, under good testing conditions during regular class hours. Tests requiring speaking or listening were administered in the language laboratory. Tests similar in nature (e.g., Reading Aloud I and II) were given at least a week apart. The predictor tests were given early in the semester, the criterion tests at the end.

The two studies will be reported in the following order:

Study I—Variables, factor analysis, multiple correlation analysis

Study II—Variables, factor analysis, multiple correlation analysis

Results

STUDY I

Variables

The data for the first study consisted of scores on 21 test variables and two criteria. The test variables were chosen to represent factors which, on the basis of teaching experience and linguistic theory, were hypothesized to be related to success in learning a foreign language. The hypothesized factors were associative memory, analytic reasoning, reasoning by analogy, physical dexterity in articulation, ability to change linguistic set, auditory discrimination, interest in foreign languages, and several others Tests were either found or constructed to represent the hypothesized factors in as "pure" a manner as possible.

It appeared desirable to try out a large number of such predictor variables. As there were more tests than could be given in a single semester, the first study omitted several factors of potential importance, such as auditory discrimination and language interest, which then appeared in the second study.

The 23 variables which provided the data for the first study are as follows:

1. Modern Language Aptitude Test (MLAT), Part III—Spelling Clues (Carroll & Sapon, 1955). The subject chooses which of five words has the same meaning as the word represented in abbreviated form Sample: kataklzm—(*a*) mountain lion, (*b*) disaster, (*c*) sheep, (*d*) chemical reagent, (*e*) population. Highly speeded: 50 items, 8 minutes.

2. MLAT, Part I—Number Learning. By tape recording, the subject is taught a simple artificial system of number expression utilizing nonsense syllables. He is then asked to write down the arabic numeral equivalents of a list of 2- and 3-digit numbers in the artificial system spoken at a fairly rapid pace on the tape This version utilizes the digits 0, 1, 2, 3, 4. Fifteen items, total time 10 minutes.

3 MLAT, Part IV—Words in Sentences. This test was designed to measure the ability to understand the function of words and phrases in sentence structure, without calling on knowledge of grammatical terminology. Each item consists of a "key sentence" with a word or phrase capitalized, followed by one or more sentences with other words or phrases underlined and numbered. The subject is directed to pick the word or phrase in the second sentence (or sentence-group)

which does the same thing in that sentence as the capitalized word does in the key sentence.

Sample:

He spoke VERY well of you.
Suddenly the music became *quite loud.*
1 2 3 4

The test contains 45 items. The time allowed is 15 minutes.

4. MLAT, Part V—Paired Associates. The subject studies a list of 24 "Kurdish-English" vocabulary equivalents for 2 minutes; in the next 2 minutes he practices recalling the English meanings, and he then has 4 minutes to complete from memory a multiple-choice test of the presented vocabulary (24 items).

5. Letter Series (adapted from Guilford). A series of seven letters is given, to which the subject must add the next two Sample:

D E F D E F – – .

6. Reading Aloud I (speed). The subject is given time to study a meaningful paragraph of English prose, then is asked to record his reading of it, "speaking as quickly as possible while still remaining intelligible." Score is number of words read in 30 seconds.

7. Same test (accuracy). Number of errors made in 6.

8. Reading Aloud II (speed). The subject is given time to study a meaningless paragraph made up of English words put together at random. He then records his reading of it "speaking as quickly as possible while still remaining intelligible." Score is number of words read in 30 seconds.

9. Same test (accuracy). Number of errors made in 8.

10. Paraphrase. The subject is to give as many paraphrases as possible for a given phrase. Sample: for TO DIE, the subjects might give "to kick the bucket," "to cash in one's chips," etc Score is number of paraphrases given in 4 minutes.

11. Rhymes. The subject is to give as many words as possible that rhyme with four given words (LAKE, CLOUD, SO, GRASS). Score is number of rhymes given in 2 minutes.

12. Synonyms. The subject is to give as many synonyms as possible for four given words Sample: for GO, the subject might give "ride," "drive," "fly," "travel," etc. Score is number of synonyms given in 4 minutes.

13. Phonetic Perception. The subject hears three sounds and must tell which one is different from the other two. The test uses distinctions which are nonphonemic in English (e.g., "r" vs. "rr"). Twenty items, 5 minutes.

14. Linguistic Analysis I. The subject is given a list of 22 foreign forms (adapted from Kabardian) together with their English equivalents. By consulting the given forms, he is to deduce how other things are said in this language. Ten multiple-choice items, 12 minutes.

15. Linguistic Analysis II The subject is given a list of 19 forms in a foreign language (adapted from Kabardian) together with their English equivalents By consulting the given forms, he is to deduce the meanings of a number of other foreign forms given to him. Ten multiple-choice items, 12 minutes.

16. Verbal Comprehension (Guilford-Zimmerman). A test of English vocabulary knowledge. Forty items, 6 minutes.

17. Age The subject gives his age at last birthday and is placed in one of five categories· under 18, 18-20, 20-22, 22-25, over 25

18. Sex. Female or male, scored zero or one.

19. Bilingualism. To be rated as "bilingual" a subject has to answer either or both of the following questions affirmatively: Is a language other than English spoken regularly in your home? Is your native language other than English? Scored zero for mono-, one for bilingualism.

20. High School Language Grades. An average of grades in high school language courses.

21. High School Math-Science Grades. An average of grades in math and science courses in high school.

22. (Criterion) French II Final Grades. Letter grade assigned by teacher at end of second semester of college French. (A, B, C, D, F = 4, 3, 2, 1, 0).

23. (Criterion) French Speaking Proficiency Test. A five-part recorded test of ability to speak French at end of second semester Scored by native judges.

Factor Analysis

A matrix of zero-order Pearson correlations was computed from the scores of the 208 subjects on the 23 variables just described. These correlations, together with the means and standard deviations of the variables, are shown

in Table A.[2] From this matrix, eight centroid factors were extracted and then rotated, using Kaiser's normal varimax criterion (Kaiser, 1958).[3] Table B presents the rotated factor matrix. Loadings of less than .30 were not considered significant. Descriptions of the eight factors follow:

Factor A: Reasoning. This factor is made up of seven variables (loadings shown at right).

2.	Number Learning	.57
21.	High School Math-Science Grades	.50
14.	Linguistic Analysis I	.48
3.	Words in Sentences	.43
15.	Linguistic Analysis II	.35
5.	Letter Series	.34
22.	French II Grades (criterion)	.34

This factor resembles others variously called General Reasoning, Verbal Reasoning, Induction, etc., in previous factor analytic findings. It appears to include the ability to induce the orderly principle in a group of examples (e.g., Letter Series), and to apply this principle to a variety of new examples (e.g., Number Learning).

Factor B: Word Fluency. The variables with sizable loadings on this factor are:

10.	Paraphrase	.65
12.	Synonyms	.64
11.	Rhymes	.41

The identification as Word Fluency requires some amplification. Word Fluency is usually defined as the ability to produce words which conform to certain structural limitations, e.g., four-letter words of the types s – – e. In the present case, the limitations are not structural but semantic. Both kinds of tests entered into factors called Word Fluency by previous investigators (Carroll, 1941; Thurstone, 1941). The factor found here most nearly resembles Guilford and Christensen's (1956) Eduction of Conceptual Correlates. The name Word Fluency has been retained because it is more familiar.

Factor C: Biographic. This factor is made up of:

10	Sex—scoring code: feminine = 0, masculine = 1	.64
20.	High School Language Grades	−.58
17.	Age	.52
4	Paired Associates	−.34
3.	Words in Sentences	−.31

This factor seems to reiterate the well-known fact that girls do better than boys in high school language courses. However, at the college level, sex fails to correlate significantly with either criterion (−.02 and −.08, respectively).

Factor D: Achievement in French. This factor is made up of the two criteria:

23.	French Speaking Test	−.65
22.	French II Grades	−.57

It seems to represent a unique portion of the variance in the criteria. It may be pointed out that the two criteria were arrived at in different ways, by different judges.

Factor E: Speed of Articulation. Two variables have significant loadings:

[2] Tables A, B, C, and D have been deposited with the American Documentation Institute. Order Document No. 6943 from ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress; Washington 25, D. C., remitting in advance $1.25 for microfilm or $1.25 for photocopies. Make checks payable to: Chief, Photoduplication Service, Library of Congress.

[3] The factor analytic computations in Study I were performed on SWAC, an electronic computer located on the campus of UCLA and supported by the Office of Naval Research.

8.	Reading Aloud II (speed)	−.71
6.	Reading Aloud I (speed)	−.68

The identification seems clear.

Factor F: ? The variables included in this factor are:

5.	Letter Series	−.42
13.	Phonetic Perception	−.37
19.	Bilingualism	.34
15.	Linguistic Analysis I	−.32

The meaning of this factor is not clear, beyond the fact the bilinguals perform poorly in the three other variables No interpretation will be attempted, as these variables appear again in the next study.

Factor G: Response Set. The two variables composing this factor are:

9.	Reading Aloud II (errors)	−.48
7.	Reading Aloud I (errors)	−.44

This factor, reflecting the number of errors made while reading a passage at top speed, may be interpreted as Response Set, i.e., the tendency of some to avoid mistakes by working a little slower, while others work very rapidly even at the risk of making mistakes.

Factor H: Verbal. Three variables make up this factor:

16.	Verbal Comprehension	.59
1.	Spelling Clues	.43
11.	Rhymes	.37

The chief loading being that of an English vocabulary test, this may be identified as the Verbal or Verbal Knowledge factor.

Summarizing the factors whose identification appears clear, they are: Reasoning, Word Fluency, Biographic, Achievement in French, Speed of Articulation, Response Set, and Verbal.

Multiple Correlation Analysis

A multiple correlation coefficient, R, was computed[4] for each of the two criteria, using as predictors the entire battery of 21 tests. The results, together with the proportion of variance contributed by each variable, are presented in Table 1, Columns A and C.

Reduction was attempted in the size of the batteries. The three or four tests making the highest contributions were chosen as a basic battery. To these were added other tests, singly or several at a time, in many different combinations, and the resulting Rs computed. The batteries shown in Table 1, Columns B and D, are those which minimize the number of tests while maximizing the multiple correlation coefficient.

For predicting French grades, the minimum battery consists of Number Learning (or Spelling Clues), Words in Sentences, Letter Series, Reading Aloud I, Paraphrase, Linguistic Analysis II, age, and high school math-science grades This seven-test battery yields a multiple R of .43. The inclusion of Number Learning or Spelling Clues gives approximately the same results; the inclusion of both does not raise the R appreciably.

For predicting Speaking Test scores, the minimum battery consists of Spelling Clues, Letter Series, Reading Aloud II, Verbal Comprehension, and Bilingualism. This five-test battery yields a multiple R of .42.

In evaluating the multiple correlation coefficients, several factors which militate against accurate prediction must be taken into account. The first of these is the unreliability of the teacher grades used as one of the criteria. If grades are assumed to have a reliability of, say,

[4]This part of the analysis used the BIMD-6 program supplied by the Biostatistics Laboratory, Department of Preventive Medicine, UCLA. The computations were performed on an IBM 709 computer, through the cooperation of the Western Data Processing Center, UCLA.

TABLE 1

STUDY I: MULTIPLE CORRELATION ANALYSIS

Variable	French II Grades		French Speaking Test	
	A (21 tests)	B (7 tests)	C (21 tests)	D (5 tests)
1. Spelling Clues	.033		.058	.058
2. Number Learning	.025	.036	.002	
3. Words in Sentences	047	063	.007	
4. Paired Associates	.002		.003	
5. Letter Series	.008		.019	.024
6. Reading Aloud I (speed)	.021	.029	.023	
7. Reading Aloud I (errors)	.000		.003	
8. Reading Aloud II (speed)	.002		.010	.027
9. Reading Aloud II (errors)	.014		.001	
10. Paraphrase	.009	.012	.001	
11. Rhymes	.001		.000	
12. Synonyms	.000		.000	
13. Phonetic Perception	.005		008	
14. Linguistic Analysis I	.000		.000	
15. Linguistic Analysis II	.010	.012	.004	
16. Verbal Comprehension	.002		.036	.044
17. Age	.012	012	002	
18. Sex (feminine = 0, masculine = 1)	.001		.001	
19. Bilingualism	.022	024	028	.023
20. High School Language Grades	.004		000	
21. High School Math-Science Grades	.008		.001	
	$R = .478$	$R = .433$	$R = .454$	$R = .418$

Note.—Proportion of variance contributed by each variable to the prediction of each criterion. A and C—using all tests, B and D—using the most economical battery.

.70, then the correction for attenuation raises the multiple R from .43 to .52. The Speaking Test criterion might be similarly corrected, though there is some evidence to show that it has high reliability (Pimsleur, 1961). A second consideration is the fact that certain potentially important variables were not included. The use of additional variables and more reliable criteria are features of the second study. A third consideration is the restriction in range of ability among the examinees. The college population is highly select; the second semester population of French students is even more so. This homogeneity makes accurate prediction very difficult.

STUDY II

Variables

In Study II, a somewhat different set of variables was used. Those which had proven uninteresting in Study I were discarded. Others were added to tap additional factors, e.g., Numbers 9 through 12, dealing with an auditory factor, and Numbers 13 and 14, treating interest or motivation. Despite their good results in the first study, the MLAT parts were dropped because they contain copyright material and so could not be used in developing a new battery.

The last three variables are three

criteria, all new to this study. The Cooperative French Test was used as a measure of achievement in the reading and writing goals. Oral achievement was rated by a laboratory instructor who had listened to students and graded them in the lab once a week for a full semester. Achievement in understanding spoken French was measured by the Pictorial Auditory Comprehension Test, an objectively scored test.

The variables for Study II are these:

1. Verbal Comprehension (Guilford-Zimmerman). See Study I for description.
2. Linguistic Analysis I. See Study I
3. Ship Destination Test (Christensen-Guilford). Find the distance from ship to shore considering the influence of several variables. Thirty-three items, 15 minutes.
4. Grammatical Transformations. The subject is given a sample transformation (e g., "They are good. Books are interesting." → "Good books are interesting.") In a new item, he is to select from among four choices the one which represents a transformation similar to the sample (e.g., "It is noisy. Telephones are annoying." → "Noisy telephones are annoying.") Twenty items, 9 minutes.
5. Paraphrase. See Study I.
6. Rhymes. See Study I.
7. Reading Aloud I. See Study I.
8. Reading Aloud II. See Study I.
9. Phonetic Perception. See Study I.
10. Chinese Pitch Perception Subject is taught three Chinese words which differ only in pitch. These are then imbedded in Chinese sentences and subject must tell which he hears. Thirty items, 10 minutes.
11. Seashore Pitch Test. Subject hears two tones, must tell whether the second is higher or lower than the first. Thirty-five items, 5 minutes.
12. Seashore Timbre Test Subject hears two chords, must tell whether the second is the same or different than the first. Thirty-five items, 5 minutes.
13. Interest I. Twenty items relating to interest in language. Subject answers each on a five-point scale.
14. Interest II. The subject is asked to rate on a five-point scale the extent of his interest in studying the foreign language he is now studying.
15. Bilingualism. See Study I.
16. Age. See Study I.
17. Sex. See Study I.
18. High School Language Grades. See Study I.
19. High School Math-Science Grades. See Study I.
20. (Criterion) Cooperative French Test, Advanced Forms Q and R. A standardized test of achievement in reading, grammar, and vocabulary Total scores were used.
21. (Criterion) Lab Grade. An estimate of speaking ability given by laboratory instructor on basis of listening to student all semester, plus a final oral test. Grades from 0 to 11
22. (Criterion) Pictorial Auditory Comprehension Test. An objectively scored test of French listening comprehension. Subject must select from among four pictures the one which correctly illustrates the sentence he has just heard. Tape recorded, 50 items, 20 minutes.

Factor Analysis

From the scores of 202 subjects on the 22 variables a matrix of zero-order correlations was computed. It is presented, together with the means and standard deviations of the variables, in Table C. From this, eight factors were extracted and rotated.[5] The rotated factor matrix is presented in Table D.

The analysis yielded eight factors, all of which could be identified, though with varying degrees of assurance.

Factor A: Achievement in French (Verbal). The first factor is composed of seven variables (loadings at right).

20.	Cooperative French Test (criterion)	.73
21.	Lab Oral Grade (criterion)	.55
22.	Aural Test (criterion)	.52
1.	Verbal Comprehension	.47
18.	High School Language Grades	.44
13.	Interest I	.35
17.	Sex	−.31

This factor is ambiguous. The first three variables are the three criteria, and

[5]This part of the analysis used the BIMD-17 program, on the 709 computer.

appear therefore to compose a factor specific to achievement in learning French. Here, they are associated however with a verbal component (Tests 1 and 18), and a component of motivation or interest (Test 13).

Factor B: Speed of Articulation. This factor is made up of:

8.	Reading Aloud II	77
7.	Reading Aloud I	.71

The identification is clear. However, these variables did not correlate highly with the criteria, as they did in the first study. For example, Reading Aloud I correlated .20 (significant beyond the .01 level) with the first criterion in the previous study, but only .04 (nonsignificant) with the first criterion in the present study.

Factor C: Reasoning. The components of this factor are:

19.	High School Math-Science Grades	.51
3.	Ship Destination Test	.46
2.	Linguistic Analysis I	.37
4.	Grammatical Transformations	.32

This factor seems easily identified as Reasoning, or General Reasoning. The first two tests (19 and 3) are nonverbal in nature, while the other two (2 and 4) involve linguistic tasks. This factor shows a close relation between verbal and nonverbal reasoning.

Factor D: Biographic. This factor consists of:

16.	Age	.56
1.	Verbal Comprehension	.39
17.	Sex	.37
18.	High School Language Grades	−.31

It seems appropriate to consider this a biographic factor, though its interpretation is not clear. It is of interest that sex, which did not correlate significantly with the criteria in the first study, did do so in the second.

Factor E: Pitch Discrimination. The variables which form this factor are:

11	Seashore Pitch Test	.50
10.	Chinese Pitch Test	.44
4	Grammatical Transformations	.37

The identification as pitch discrimination seems correct. It should be noted that the two pitch tests (11 and 10) are quite different in nature, the former involving pure tones and the latter involving language. These two pitch tests correlate significantly with the first and third criteria, but not with the second one. The presence of Test 4 on this factor is not readily explainable.

Factor F: Word Fluency. This factor is made up of:

5.	Paraphrase	.50
6.	Rhymes	.41
15	Bilingualism	−38

The identification is clear. The presence of Test 15 merely means that foreign subjects have less word fluency in English than do Americans.

Factor G: Interest in Languages. The two variables composing this factor are:

14	Interest II	.70
13.	Interest I	.67

The identification presents no difficulty. Both these variables correlate significantly with all three criteria.

Factor H: Timbre Discrimination. This factor consists of:

9.	Phonetic Perception	.36
12.	Seashore Timbre Test	.35

The first of these variables (9) involves actual language sounds, while the other

(12) involves nonlanguage tones. Though the loadings are low here, it is nevertheless intriguing that pitch and timbre appear as two distinct factors. These two variables correlate significantly with the third (aural) criterion, but not with the other two.

Multiple Correlation Analysis

The test selection procedure differs somewhat from that used in the first study. Here, a stepwise regression program was used in conjunction with a multiple correlation program, the former to find the best one-test battery, best two-test battery, etc., up to 9 or 10 tests, and the latter to determine the multiple R and the contributions to variance of each test in each of the best batteries.[6]

Results of the analysis are presented in Table 2. As can be seen in Column A of Table 2, the criterion of Cooperative French Test scores can be predicted to the extent of $R = .673$ when all 19 tests are used. The number of tests may be reduced considerably, without much loss in predictive accuracy. Column B shows the best six-test battery for predicting this criterion. This is a modest battery which can be administered in a 50-minute class period; it yielded an R of

[6]The programs referred to are BIMD-6 and BIMD-9.

TABLE 2

STUDY II: MULTIPLE CORRELATION ANALYSIS

Variable	Criterion 20: Cooperative French Test		Criterion 21. Lab (oral) Grades		Criterion 22: Auditory Comprehension	
	A (19 tests)	B (6 tests)	C (19 tests)	D (5 tests)	E (19 tests)	F (5 tests)
1. Verbal Comprehension	.193	.193	.021	.021	.075	.075
2. Linguistic Analysis	.017		001		.030	.030
3. Ship Destination	.000		000		.000	
4. Grammatical Transformations	.004		.002		001	
5. Paraphrase	.000		000		.004	
6 Rhymes	010		.015		003	
7. Reading Aloud I	.002		.006		.000	
8. Reading Aloud II	.001		.018		.001	
9. Phonetic Perception	.001		.002		.008	
10. Chinese Pitch	.019	.024	.005		.011	.015
11 Seashore Pitch	.000		.000		.002	
12. Seashore Timbre	.004		.000		.009	.013
13. Interest I	.123	.125	040		.032	031
14 Interest II	.020	.021	.009	.052	.001	
15. Bilingualism	.007		.003	.009	.000	
16. Age	.006		.008		.000	
17. Sex	.022	.037	.013		.003	
18. High School Language	.019	.024	.048	.073	005	
19. High School Math-Science	003		.016	013	.005	
	$R = .673$	$R = .652$	$R = .457$	$R = .410$	$R = .436$	$R = .405$

Note —Proportion of variance contributed by each variable to the prediction of each of 3 criteria: A,C,E—using all tests; B,D,F—using the most economical battery

.652 (estimated shrinkage, $R = .646$).[7] Two improvements in the second study as compared with the first probably account for the more satisfactory result. They are the use of a more reliable criterion, i.e., a standardized test in place of teacher grades, and the inclusion of new variables which turned out to be quite important.

The other two criteria can also be predicted by a small battery of tests, as may be seen in Columns D and F of Table 2. However, these multiple *R*s are considerably lower than those for the Cooperative French Test, probably due to the lower reliability of the other two criteria.

RESULTS

Prognosis

By far the best predictive accuracy was obtained in the prediction of Cooperative French Test scores, in Study II. A multiple correlation coefficient of $R = .652$ was arrived at by a six-test battery that can be administered in less than an hour. While this battery has not yet been validated on other samples (such work is under way), it appears to be as good a device for predicting success in foreign language learning in college as is now available. The regression equation for predicting Cooperative French Test scores is:

$$Y' = 47.37 + .47X_1 + .18X_{10} + .09X_{13} + 1.21X_{14} - 2.15X_{17} + 1.82X_{18} \quad [1]$$

As for the other two criteria, speaking ability and listening comprehension, the multiple correlation coefficient obtained for each of them was approximately .41, with a battery of five tests. The regression equations associated with the prediction of these two criteria in Study II are, respectively:

$$Y' = 3.25 + .04X_1 + .31X_{14} + .64X_{15} + .98X_{18} - .37X_{19} \quad [2]$$

$$Y' = 17.80 + .25X_1 + .37X_2 + .13X_{10} + .16X_{12} + .09X_{13} \quad [3]$$

Diagnosis

The manner in which prediction of Cooperative French Test scores was achieved merits attention. The tests contributing to this prediction are Verbal Comprehension, Interest I and II, Chinese Pitch, Sex, and High School Language Grades; i.e., they represent factors of verbal intelligence, motivation, pitch discrimination, and certain biographic elements. While the predictive accuracy they afford is satisfying, it does not come about in the way one might wish. It had been hoped that foreign language achievement could be predicted on the basis of *intellectual* factors, such as the ability to discriminate sounds, to induce grammatical principles, and so on. Instead, it appears from these studies that the two biggest factors in such achievement are the very general ones of verbal IQ and motivation. This finding says that as far as language study in college is concerned, anyone will do well who is intelligent and wants to learn, regardless of such concerns as having "a good ear," "a good memory," and "good reasoning powers."

Nonetheless, it is of interest to examine the relative importance of the factors which contribute to the prediction of each criterion.

Though the first criterion (the grammar-reading goal) was measured in quite different ways in the two studies, this fact will be ignored for the moment, to permit comparison of the two sets of findings. These are the tests which contributed 1% or more to prediction of the first criterion:

[7] Shrinkage estimated by McNemar's Formula 75. See McNemar (1955, p. 186).

Study I		
3.	Words in Sentences	.047
1.	Spelling Clues	.033
2.	Number Learning	.025
19.	Bilingualism	.022
6.	Reading Aloud I	.021
9.	Reading Aloud II (errors)	.014
17.	Age	.012
15.	Linguistic Analysis II	.010
Study II		
1.	Verbal Comprehension	.193
13.	Interest I	.123
17.	Sex	.022
14.	Interest II	.020
18.	High School Language	.019
10.	Chinese Pitch	.019
2.	Linguistic Analysis I	.017
6.	Rhymes	.010

In Study I, three of the tests (3, 2, 15) are associated with the Reasoning factor. Test 1 is associated with the Verbal factor. Test 6 is associated with Speed of Articulation; Test 9 with Response Set; Test 17 with the Biographic factor.

The factorial findings in Study II differ partly from those of Study I, since different tests are involved. In Study II, Tests 1 and 18 are associated with a Verbal factor; Tests 13 and 14 with an Interest (motivation) factor; Test 17 with a Biographic factor; Test 10 with a Pitch Discrimination factor; Test 2 with a Reasoning factor; Test 6 with a Word Fluency factor. The Verbal, Reasoning, Word Fluency, and Biographic elements were found in both studies. The interesting Speed of Articulation finding of the first study was not confirmed by the second. Interest and Pitch Discrimination are new additions in the second.

These findings permit the tentative conclusion that achievement of the traditional (grammar, reading, writing) objectives of a college French course involve primarily verbal intelligence and motivation on the student's part, but may also involve his ability to reason both analytically and by analogy, and his ability to think up words quickly.

In order to examine the two sets of findings with regard to oral (speaking) achievement, the difference between the two measures of the criterion will again be ignored. There follows a summary of the tests which contribute 1% or more to the prediction of this criterion:

Study I		
1.	Spelling Clues	.058
16.	Verbal Comprehension	.036
19.	Bilingualism	.028
6.	Reading Aloud I	.023
5.	Letter Series	.019
8.	Reading Aloud II	.010
Study II		
18.	High School Language	.048
13.	Interest I	.040
1.	Verbal Comprehension	.021
8.	Reading Aloud II	.018
19.	High School Math-Science	.016
6.	Rhymes	.015
17.	Sex	.013

Represented in the findings of Study I are the Verbal factor (Tests 1 and 16), the Speed of Articulation factor (6 and 8), and the Reasoning factor (5). The factors represented in Study II are Verbal (Tests 1 and 18), Interest in Language (13), Speed of Articulation (8), Reasoning (19), Word Fluency (6), and Biographic (1, 17, 18).

These findings suggest that in order to do well in learning to *speak* French in college the student must possess, above all, verbal intelligence and high motivation, and that in addition he may be helped by his analytic reasoning ability, his ability to articulate words rapidly, and his ability to think them up.

As for the third criterion, listening comprehension, it is predicted by:

Study II		
1.	Verbal Comprehension	.075
13.	Interest I	.032
2.	Linguistic Analysis I	.030
10.	Chinese Pitch	.011
12.	Seashore Timbre	.009

The factors involved here are, again, verbal intelligence and motivation, plus reasoning, pitch discrimination, and timbre discrimination.

It is concluded from the studies thus far completed (*a*) that achievement in a traditional (grammar-reading) language course may be predicted with reasonable validity by a set of tests, each of which taps only one rather precise characteristic of the learner; (*b*) that nonintellectual characteristics, notably motivation, must be included as well as intellectual ones; (*c*) that oral and aural achievement are less subject to satisfactory prediction at the present time, probably due to the lack of adequate criterion tests for achievement in these skills; (*d*) that although better criterion tests will improve prediction somewhat, substantial improvement probably demands the inclusion of entirely new factors as predictors; (*e*) that among such new factors, the personality of the student and the characteristics of the teacher are those which appear most promising and are most in need of research attention.

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