SOME EFFECTS OF BILINGUALISM UPON THE INTELLIGENCE TEST PERFORMANCE OF PUERTO RICAN CHILDREN IN NEW YORK CITY

ANNE ANASTASI and FERNANDO A. CORDOVA
Graduate School, Fordham University

Bilingualism is generally recognized as a serious difficulty in the comparative psychological testing of many groups. Although not restricted to this country, the problem is especially cogent in America, with its variety of foreign-speaking subcultures. Many studies on American Indians and on European and Asiatic immigrant groups in America have compared the test performance of bilingual children with that of monolingual, English-speaking children within the same national or racial groups, as well as with the American norms (cf. 1, pp. 717-725; 3; 4; 29). Such investigations have consistently demonstrated that the substitution of a non-verbal for a verbal test reduces the inferiority of the bilinguals. In some instances, the inferiority disappears completely with the use of the non-verbal test. The relative position of the groups may even be reversed, the bilingual excelling the monolingual on such a test. The latter result is especially likely to occur when the non-verbal test is of the performance type (cf, e.g., 15).

The interpretation of such findings on bilingualism is complicated by a number of factors. In the first place, it cannot be assumed that verbal and non-verbal tests measure the same functions. The specific abilities called into play by these two types of tests may, and probably do, differ. Do bilinguals score higher on performance than on verbal tests only because their

---

1 The present paper is based in part upon an M.A. Dissertation submitted by the junior author to the Department of Psychology, Fordham University (cf. 18).
insufficient mastery of English handicaps them on the latter
tests? Or does the difference in score reflect inequalities in the
relative strength of verbal and spatial abilities in the particular
group? The bilingual group under investigation may have been
reared in a culture which selectively fosters the development of
spatial aptitude (or some other ability or combination of abilities
involved in the performance test), while discouraging the develop-
ment of verbal skills.

A second and closely related point to consider is that bilingual-
ism is often correlated with other differences in cultural back-
ground which may influence test performance. The bilingual is
likely to differ from the American normative population in his
general information, work habits, interests, and motivation. The
degree of bilingualism, moreover, is probably related to the
amount of deviation in these other cultural factors. There is
evidence, too, that in certain situations more personal maladjust-
ment occurs among bilinguals than among monolinguals (30).
To be sure, such maladjustment appears to result primarily from
the cultural conflict confronting a second generation immigrant
group, but the bilingualism makes the conflict more acute, since
it serves as a symbol and constant reminder of such conflict.

A third complicating factor is to be found in the possible
influence of bilingualism upon rapport in the testing situation.
The bilingual may score higher when tested in one than when
tested in the other of his two languages. In a study of Spanish-
speaking school children in Arizona, for example, the children
obtained higher IQ's on a non-verbal test when the oral instruc-
tions were given in Spanish than when they were given in
English (24). Such a difference may result from a more com-
plete mastery of the one language. But it could also arise,
wholly or in part, from a more favorable emotional response
toward the examiner who speaks the language with which the
individual identifies himself more closely. There is evidence to
suggest that both Negro and white children perform better on
intelligence tests when the examiner is a member of their own
race than when he is a member of a different race (6). Like skin
color, language may serve as a reduced cue for group identifica-
tion and it may influence the examiner-subject relationship in a
similar manner.

Finally, it should be noted that bilingualism itself may be of
Some Effects of Bilingualism

more than one type. Whether or not bilingualism constitutes a handicap, as well as the extent of such a handicap, depends upon the way in which the two languages have been learned (26, 31). In immigrant families, the child often learns one language at home and another at school. The result is a sort of 'linguistic bifurcation,' whereby one language develops in one set of situations and the other in another set. Mastery of both languages is thus limited. It is not the interference between the two languages so much as the restriction in the learning of each to certain areas that leads to handicap. In such cases, the extent of the child's vocabulary as well as other aspects of his linguistic development will be inferior in both languages (5, 28). By contrast, the individual who learns to express himself in all types of situations in at least one language will probably suffer no handicap from learning a second language. Such a situation might be described as 'bilingual parallelism,' since the second language provides a parallel means of expression in some or all situations, depending upon the thoroughness of its mastery.

The present investigation is concerned with the rôle of bilingualism in the intelligence test performance of Puerto Rican children in New York City. The native language of the Puerto Rican is Spanish, although English is taught in the Puerto Rican schools. Unfortunately, an ill-advised educational policy with regard to the way in which English was introduced into the Puerto Rican schools has served only to make many Puerto Ricans 'illiterate in two languages,' and has prejudiced them against English, which they blame for their educational difficulties and confusions (23, p. 12). The dark-skinned Puerto Rican migrant, moreover, is encouraged to remain Spanish-speaking, since as a foreign-speaking Negro he tends to enjoy higher status in the United States than does the native American Negro (23, p. 87). Such a hybrid Puerto Rican prefers to be identified as a 'Latino' rather than as a Negro. For these and other reasons, the Puerto Rican migrant makes little use of what English he knows. Consequently, Puerto Rican children in New York City are virtually monolingual until school entrance, having had little or no opportunity to learn English in their own home or community. This persisting linguistic barrier is a handicap in the child's school adjustment and in his educational progress. The language problem is also undoubtedly a major reason for the
The Journal of Educational Psychology

scarcity of psychological data on this large and rapidly growing immigrant group.

A recently completed sociological survey by Mills, Senior, and Goldsen (23) provides some information on the cultural background, socio-economic level, living conditions, interests, and outlook of New York City Puerto Ricans. Strong in-group feeling, low occupational level, and a widespread pessimism regarding the chances of improving their status were characteristic of the sample of 1113 respondents interviewed in this survey. Similarly, an analysis of 188 Puerto Rican first admissions to all New York State mental hospitals during a single year indicated low educational and socio-economic status and a relatively high proportion of cases with subnormal intelligence (22).

Only two investigations have been reported in which psychological tests were administered to Puerto Ricans within continental United States, both having been conducted in New York City. The earlier of the two was carried out by Dunklin (16) in 1934-1935. Thirty-five Puerto Rican public school children, enrolled in a special section of the first grade taught entirely in Spanish, were given a Spanish translation of the Pintner-Cunningham Primary Test, the Pintner Non-Language Primary Test, the Pintner-Paterson Performance Scale, and another performance test developed by the author. On the two individual performance tests and on the Pintner Non-Language Test, the median IQ of the Puerto Rican children was virtually equal to the American norms, but on the Pintner-Cunningham it was only 73.

The other psychological study of New York City Puerto Ricans was that of Armstrong, Achilles, and Sacks (2), reported in 1935. The Army Individual Performance Test was given to 240 Puerto Rican public school children in grades four to six, most of whom were between the ages of nine and fourteen. In addition, the Otis Test of General Ability for grades four to eight was administered in English to 129 of the fifth- and sixth-grade children. As a 'control group,' the authors employed a sampling of over 400 nine- to fourteen-year-old public school children drawn from Manhattan and Westchester County. On both the performance and the verbal test, the mean scores of the Puerto Ricans were lower than those of the control group, the critical ratios of these differences being 7.099 and 9.504, respectively. From these findings, the authors drew rather sweeping conclusions regarding
the inferiority of Puerto Rican intelligence, their report arousing considerable controversy (cf., e.g., 11). Chief among the difficulties in the way of interpreting the results of this study may be mentioned language handicap, problems of rapport and test motivation, and lack of comparability of Puerto Rican and control groups, especially with reference to socio-economic level.

It may be of interest to consider also some results obtained from the testing of Puerto Rican children outside of continental United States. Porteus (27) reports mean Stanford-Binet and Porteus Maze IQ's of 71.72 and 74.87, respectively, for a group of 429 Puerto Rican children tested in Hawaii. The subjects were all clinic cases, brought to the Psychological Clinic of the University of Hawaii, and included delinquent, educationally retarded, mentally defective, and dependent children, from the lower half of the socio-economic scale. Within this group, the Puerto Rican children scored lower than any of the other national samples tested. There is no indication of how the language problem was handled, if at all. Moreover, the possibility of differential selection of various national subgroups within the clinic population needs to be taken into account. An extensive and better controlled investigation was conducted in Puerto Rico under the direction of The International Institute of Teachers College, Columbia University, and reported in 1926 (25). In addition to island-wide testing with school achievement tests given both in English and in Spanish, this study included the administration of the Pintner Non-Language Mental Ability Test to 1000 children in grades three to eight. In the latter test, the Puerto Rican children excelled the American norms in grades three, four, and five, but fell below these norms in the next three grades.

PROCEDURE

In the present investigation, Puerto Rican children in the upper three grades of a New York City elementary school were tested with the Cattell 'Culture Free' Test, Forms 2A and 2B, designed for ages eight to twelve and unselected adults (7, 8, 9, 10). This is a non-verbal test, all items being perceptual or spatial. Cattell maintains, moreover, that the oral instructions for this test can be translated without altering the validity of the test (9, p. 3). It should be added that for the present purpose no assumption
has been made that this test is actually 'culture free.' No test
can be completely 'culture free,' nor even 'culture constant,'
since the content of any test will tend to favor one or another
culture. The elimination of specific culturally limited inform-
ation from a test is only a partial and superficial solution.
Each culture stimulates the development of certain abilities and
interests, and inhibits others. The resulting psychological differ-
ences will inevitably be reflected in test performance, as in any
other behavior of individuals reared in diverse cultural settings.
In the Cattell test, for example, the items consist almost exclu-
sively of abstract geometric forms and patterns; and the test is,
of course, of the paper-and-pencil variety. Individuals having
relatively little interest and practice in intellectual games and
those who have developed antagonistic or discouraged attitudes
toward purely academic activities would quite probably be at a
disadvantage on such a test, which provides little practical appeal.

The plan of the present experiment was to administer Form A
in English to one half of the subjects (Group 1), and Form A
in Spanish to the other half (Group 2). After an interval of two
weeks, Form B was given with a reversal of the two languages,
Group 1 now receiving the instructions in Spanish, and Group 2
in English. The basic experimental design was thus a 2 X 2
latin square, as shown below:

<table>
<thead>
<tr>
<th>Test Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
</tr>
<tr>
<td>Group 1</td>
</tr>
<tr>
<td>Form A: English</td>
</tr>
<tr>
<td>Group 2</td>
</tr>
<tr>
<td>Form A: Spanish</td>
</tr>
<tr>
<td>II</td>
</tr>
<tr>
<td>Form B: Spanish</td>
</tr>
<tr>
<td>Form B: English</td>
</tr>
</tbody>
</table>

Both forms of the test were employed with each language in
order to balance out any possible differences in the difficulty
level of Forms A and B. Although Cattell reports (9, p. 3) that
the two forms are equal in difficulty, such equivalence might not
hold for the present population. The study was therefore set up
in such a way as to make the assumption of equality of forms
unnecessary.

The Spanish translations of the instructions were prepared by
the junior author, who is himself a bilingual Puerto Rican, and
were independently checked by a Spanish-speaking reader. All
tests were likewise administered by the junior author, with the
assistance of classroom teachers. The children were tested in
Some Effects of Bilingualism

groups containing from thirty-five to forty-nine subjects. Preliminary introductory remarks, as well as replies to subjects' queries, were made in the same language as the instructions during any one test session.

SUBJECTS

The subjects tested in the present study included 176 boys and girls in the sixth, seventh, and eighth grades of a parochial school. The school was situated in the principal area of residence of Puerto Ricans in New York City, where the two earlier studies on New York City Puerto Ricans, described in the first part of this paper, had also been conducted. Of the total group of 176, thirty-two were omitted owing to absence from one of the testing sessions, seven because they were not Puerto Rican, and three because of zero score on one or both forms of the test. The three last-mentioned subjects had made no effort to put any marks on the test items. The remaining 134 cases were employed in determining the reliability coefficients of each form of the test. A further reduction in number was made prior to carrying out the analysis of variance, in order to have an equal number of cases in each subgroup. For this purpose, the number of cases retained was 108, consisting of twenty-seven boys and twenty-seven girls in Group 1 and the same numbers in Group 2. Within each school grade, individual subjects were assigned to Groups 1 and 2 by the experimenter in such a way as to equate the two groups as nearly as was practicable in relevant background characteristics.

At the end of the second testing session, each subject filled out a personal data form. This questionnaire was written in English, but the examiner read each question aloud in both English and Spanish, explaining how it should be answered and giving individual attention to subjects who raised questions or required assistance. The results of this questionnaire served as the basis for describing the sample under investigation, as well as for determining how closely Groups 1 and 2 had been equated. The questionnaire data are reported for only the 108 subjects used in the analysis of variance, since it is on this group that the major conclusions of the study are based.

In age, the group ranged from eleven to fifteen years, with a mean of thirteen. Nearly all parents were born in Puerto Rico,
only one or two fathers or mothers in each subgroup having been born in other Spanish-speaking countries or in the United States. Among the children, nearly half were born in Puerto Rico, the rest in New York City; nearly all had lived in New York City over three years. Since Puerto Ricans make frequent return trips to their native island, questions were also inserted to cover the number and duration of such visits. Nineteen of the 108 children reported such trips, but only four of these had remained in Puerto Rico over one year during their visits. As in other surveys of Puerto Rican migrants, the occupational level of the present group was very low. When classified according to the Goodenough and Anderson (17) occupational scale, none of the parents fell into the professional, semi-professional, clerical and skilled trades, or farmer categories. The majority were engaged in semi-skilled and slightly skilled occupations.

Nine of the eighteen items in the questionnaire were concerned with the extent of the subject’s bilingualism. These items were selected and adapted from a bilingualism scale developed by Hoffman (60). In replying to each question, the subjects checked one of the following alternatives: (a) always in Spanish; (b) more in Spanish than English; (c) about half and half; (d) more in English than Spanish; (e) always in English. Most children reported that they spoke Spanish and English about equally often with their families, a larger number clustering at the all-Spanish than at the all-English end of the scale. The rest of the family, however, most often spoke Spanish among themselves. Reading by the family scatters widely over the scale, as does letter-writing, although Spanish predominates in the latter. The children themselves employ predominantly English in their reading and writing, a fact which undoubtedly reflects the influence of the school. English language movies are the more frequently attended, although Spanish movies are well represented in the group. Radio listening shows a more even distribution of Spanish and English, with a slight predominance of English. Finally, a clear majority of the children indicated that they ‘think’ in both languages; and as between the two ends of the scale, a larger number fell at the English than at the Spanish end of the scale on this item.

The four subgroups proved to be closely equated in all of the above background variables, with only the following minor excep-
Some Effects of Bilingualism

The Group 2 boys included a slight excess of New York-born cases, were somewhat superior in parental occupational level, and reported a little more frequent use of English. Because of longer residence in this country, the families of these boys may thus have made a more effective adjustment to the American environment, both economically and culturally. That this subgroup difference was, however, too slight to have appreciably influenced the results of the present study is suggested by the fact that in over-all test performance the Group 1 boys excelled those in Group 2. The only clear sex difference noted in the questionnaire data is a greater tendency for the girls to report attendance at Spanish movies. This difference may result in part from the greater restriction of the girls' activities in Puerto Rican families, which would delay their assimilation to the American culture. But it may also be related to the nature of Spanish films, which are more often of the 'romantic' type and would thus appeal more to girls than to boys at the pre-adolescent and adolescent level.

RESULTS

Test reliability.—Split-half reliability coefficients were computed separately for Forms A and B, in both the English and Spanish versions. These coefficients were obtained by finding each subject's score on the odd items (a), the even items (b), and the total test (t), and applying the following formula (13, 19):

\[ r_{HH} = 2 \left(1 - \frac{\sigma_a^2 + \sigma_b^2}{\sigma_t^2}\right). \]

The reliability coefficients, together with the number of subjects on whom they were computed, will be found in Table 1. As a check on the applicability of an odd-even reliability technique to the present test, the degree to which the scores depended upon speed was determined. This information was also of direct

<table>
<thead>
<tr>
<th>Test Form and Version</th>
<th>N</th>
<th>( r_{HH} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>A—English</td>
<td>61</td>
<td>.92</td>
</tr>
<tr>
<td>A—Spanish</td>
<td>73</td>
<td>.84</td>
</tr>
<tr>
<td>B—English</td>
<td>73</td>
<td>.88</td>
</tr>
<tr>
<td>B—Spanish</td>
<td>61</td>
<td>.88</td>
</tr>
</tbody>
</table>
interest in so far as there are cultural differences in the emphasis placed upon speed. Such differences would be reflected in performance on a speed test.

As an index of speed, the following measure developed by Cronbach and Warrington (14) was computed for each subtest within each form and version of the test:

$$\frac{\sigma^2_{t(a)} \sum x^2_{xP}}{N\sigma^2_{x}}$$

In this formula, $\sigma^2_x$ is the total variance of the test scores, and $\sigma^2_{t(a)}$ is the variance of the number of items attempted. To find $\sum x^2_{xP}$, each person's score on the last two items attempted is averaged, the average is squared, and this quantity is then summed for all persons. Adjustments are also made for any persons who may have completed the test before time is called. Essentially, this index is based upon the extent of individual differences in number of items completed, as well as upon performance on the last two items attempted. Thus an individual who failed the last two items attempted would probably not raise his score appreciably if given time to try more, and harder, items. An estimate of the lower bound of the reliability coefficient of a speed test can be found by subtracting this index from the obtained reliability coefficient.

Table 2.—Index* Showing the Contribution of Speed to Scores on Each Subtest

<table>
<thead>
<tr>
<th>Subtest</th>
<th>Form A English</th>
<th>Form A Spanish</th>
<th>Form B English</th>
<th>Form B Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.0513</td>
<td>.6068</td>
<td>.0358</td>
<td>.0278</td>
</tr>
<tr>
<td>2</td>
<td>.0093</td>
<td>.3114</td>
<td>.0011</td>
<td>.0021</td>
</tr>
<tr>
<td>3</td>
<td>.0308</td>
<td>.0681</td>
<td>.0000</td>
<td>.0218</td>
</tr>
<tr>
<td>4</td>
<td>.0038</td>
<td>.0000</td>
<td>.0000</td>
<td>.0003</td>
</tr>
</tbody>
</table>

* Computed by formula of Cronbach and Warrington (14, p. 175).

The results of the speed analysis are given in Table 2. On the whole, the values reported in this table are quite low, all but two falling between .0000 and .0681. The two exceptions are subtests 1 and 2 of Form A administered in Spanish. Scores on these two subtests were evidently influenced to a considerable extent by speed, probably because most subjects were slow in starting after receiving the instructions. For the present pur-
pose, only total scores on all subtests are of interest. It is likely that the reliability coefficient of .84 obtained for Form A—Spanish has been spuriously raised to some extent through the contribution of speed to scores on two of its four subtests. In all other forms, however, it is apparent that speed played a negligible rôle.

Analysis of variance.—The mean scores of boys and girls in Groups 1 and 2 during each of the two testing sessions are reported in Table 3. It will be recalled that in Group 1, the first testing session was conducted in English and the second in Spanish, while the reverse order was followed in Group 2. In order to evaluate the contribution of language, session, order, and sex to test performance, the data were submitted to an analysis of variance. The type of analysis employed is essentially the same as that described by Grant (18) for a 2 × 2 latin square, except for the addition of the sex variable and the computation of the interaction of sex with each of the other three variables. The interactions among language, session, and order are confounded and lost, as in all 2 × 2 latin squares.

In order to determine the applicability of analysis of variance to the present data, the eight subgroups were tested for homogeneity of variance by the Li-test (cf. 21, pp. 82–86). The obtained value of L₁ is .9687; with f = 26 and k = 8, we find that P > .05. Hence the variances may be treated as homogeneous.

The results of the analysis of variance are summarized in Table 4. In computing the F-ratios, the subject × session interaction was used as the error term; in one case, a second F-ratio

<table>
<thead>
<tr>
<th>Testing Session</th>
<th>Group 1 (A—English; B—Spanish)</th>
<th>Group 2 (A—Spanish; B—English)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boys</td>
<td>Girls</td>
</tr>
<tr>
<td>Session 1: Form A</td>
<td>20.93</td>
<td>15.93</td>
</tr>
<tr>
<td>Session 2: Form B</td>
<td>24.52</td>
<td>22.19</td>
</tr>
</tbody>
</table>
**TABLE 4.—ANALYSIS OF VARIANCE**

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>Sums of Squares</th>
<th>Variance Estimate</th>
<th>F-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Order</td>
<td>22.686</td>
<td>22.686</td>
<td>1.152</td>
</tr>
<tr>
<td>2) Session</td>
<td>1,756.741</td>
<td>1,756.741</td>
<td>89.202*</td>
</tr>
<tr>
<td>3) Language</td>
<td>32.667</td>
<td>32.667</td>
<td>1.659</td>
</tr>
<tr>
<td>4) Sex</td>
<td>8.167</td>
<td>8.167</td>
<td>.415</td>
</tr>
<tr>
<td>5) Session X Sex</td>
<td>35.852</td>
<td>35.852</td>
<td>1.820</td>
</tr>
<tr>
<td>6) Language X Sex</td>
<td>14.518</td>
<td>14.518</td>
<td>.737</td>
</tr>
<tr>
<td>7) Order X Sex</td>
<td>580.166</td>
<td>580.166</td>
<td>29.459*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9.908*</td>
</tr>
<tr>
<td>8) Subjects (within order—within sex)</td>
<td>6,090.074</td>
<td>58.558</td>
<td>2.973*</td>
</tr>
<tr>
<td>9) Error (subjects X session)</td>
<td>2,048.222</td>
<td>19.694</td>
<td></td>
</tr>
<tr>
<td>10) Total</td>
<td>10,589.093</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Significant at .01 level.

was found with another error term, as will be explained below. It will be noted that of the four principal factors investigated, viz., order, session, language, and sex, only session yielded a significant F-ratio. This ratio, 89.202, is considerably greater than the value of 6.90 required for significance at the .01 level, with $\chi^2_{104}$ df. Such a finding indicates a large and significant practice effect, all groups scoring much higher in the second session regardless of language used. Of the 108 subjects, eighty-five improved on the retest. Since this group was taking its first psychological test, the role of test sophistication and rapport is strongly suggested by these results. Whereas in the test manual Cattell allows one point for test sophistication when Form B follows Form A (9, p. 8), the present group showed a mean rise of 5.71 points. Cattell elsewhere (8, p. 157) cites evidence to suggest that gains between Forms A and B tend to be greater for individuals with higher IQ's. In the present group, however, over-all level of performance, or IQ, was low in terms of the Cattell norms, while retest gains were relatively high. This is what would be expected when initial scores are spuriously lowered by failure to understand directions, poor motivation, and the like.
The language in which the test was administered had no significant effect upon performance. Translating the directions evidently offers no solution to the testing of these subjects. The bilingualism encountered in this group appears to be of the bifurcated variety, the children's mastery of either language being restricted and inadequate. The teachers report that these children show a reluctance to speak English. Yet in Spanish, the majority are illiterate. In connection with the present testing, a number of the children told their teachers that the Spanish used by the examiner was 'too correct' for them. Nor could this objection refer to regional differences in Spanish idiom or accent, since the examiner was a native Puerto Rican. Another interesting illustration of the linguistic bifurcation of these subjects is the difficulty which many experienced with the word 'subrayar' (to underline), which they had more often encountered in the English-speaking school situation than in the Spanish-speaking home setting. It should also be noted that the linguistic bifurcation provides a further reason for the improvement upon a retest, since by the second session all subjects had heard similar instructions in both languages, and thus had a better opportunity to complement their inadequate understanding of either language. It is clear that in future testing of Puerto Rican migrants, the best procedure is either to use exclusively non-language tests or to present the instructions in both languages.

There was no significant sex difference in over-all performance, but the sex X order interaction was significant at a high level of confidence. Such a significant interaction could result either from the differential effect of order upon the two sexes, or from the fact that the subjects differed widely among themselves, since each order was employed with a different sampling of subjects. As a check on these alternative explanations, a second F-ratio was computed for the sex X order interaction, using the subject variance as the error term. This F-ratio also proved significant, when tested against subject X session interaction as the error term. This simply means that, despite marked improvement from first to second session, subjects tended to maintain their relative status in the group. In other words, differences among individuals were significant and persisted throughout the experiment.
to be significant at the .01 level. Hence the significant interaction could not be attributed to sampling fluctuations which might have made the Group 1 girls inferior or the Group 1 boys superior by chance. The obtained interaction effect indicates that the testing order which began with English favored the boys, while that beginning with Spanish favored the girls. Such a sex difference probably reflects differences in the degree of acculturation of the two sexes. Several questionnaire items suggested that the boys were more highly Americanized than the girls. This difference may be due in part to the slight excess of New York born boys in the total sample. Another and more general explanation is to be found in the greater freedom traditionally allowed to boys in Puerto Rican families, while girls are more closely restricted to the family circle.

It is interesting to note that the language $\times$ sex interaction was not significant. Neither sex did significantly better in one language than in the other. The Spanish instructions proved as difficult as the English for all groups, probably because of the unfamiliarity of key words resulting from the subjects’ linguistic bifurcation. At the same time, the initial use of Spanish or English by the examiner may have influenced rapport, an influence which would carry over to the second test session. The boys may have felt more cooperative and at ease with an initially English-speaking examiner, the girls with an initially Spanish-speaking examiner. The sex difference would thus be a matter of attitude rather than linguistic comprehension.

Comparison with normative sample.—The over-all performance of the present group fell considerably below the norms reported in the test manual (9, p. 9). For this comparison, the Form B scores of the total sample of 108 children were converted to standard score IQ’s. The Form B norms, as given by Cattell, are based on the assumption that Form A was taken prior to Form B, as was done by the present subjects. Moreover, Cattell recommends that, with subjects lacking in test sophistication, Form B scores are a more satisfactory measure of performance, Form A serving as a practice test (8, p. 156). The median standard score IQ obtained by the present sample was 70. The range extends from two top IQ’s of 124 down to three scores indicating chance performance, i.e., raw scores below 9.2 (8, p.
Some Effects of Bilingualism

The distribution of IQ's is significantly skewed, with a piling up of scores at the lower end.

In interpreting these standard score IQ's, it should be noted that they are based on a standard deviation of 24 points, as contrasted with the more familiar 16- or 15-point \( \sigma \) in use in such scales as the Stanford-Binet and the WISC. Thus the median IQ of 70 is 1.25\( \sigma \) below the norm of 100, and would correspond to an IQ of approximately 80 or 81 in terms of the more familiar units. The nature of the normative sample must also be taken into account. The norms were obtained on 3297 British and American children, ranging in age from six to seventeen. Cattell reports that "a substantial fraction of the (normative) population . . . was taken either from two Midwestern university towns of population about twenty-five thousand each, or from a British industrial city of population about two-hundred-forty thousand" (8, p. 156). Both Midwestern towns were rated above average in cultural and social status in the survey conducted by E. L. Thorndike (cf. 8, 32). Parental occupation is not reported by Cattell, but it is almost certain that the normative sample is of much higher socio-economic level than the present group. The low socio-economic status of the Puerto Rican children, as indicated by parental occupation, is undoubtedly one factor to consider in evaluating their poor test performance. Their language handicap, limiting their mastery of both Spanish and English, is another important factor.

Even more conspicuous as a reason for the inferior test performance of the present group is the children's attitude toward the testing. A large number of factors, including lack of test sophistication, little or no motivation to excel in a competitive intellectual situation, and lack of interest in the relatively abstract and academic content of the test contributed to this attitude. The characteristic reaction to the testing was a mild confusion, followed by amusement and indifference. Such attitudes, moreover, are closely related to the poor emotional adjustment which this group makes to the school. The children were described by their teachers as 'unambitious,' many just sitting in the classroom without understanding what goes on. Their initial school experiences, involving sudden placement in an exclusively English-speaking environment at a time when they knew almost
no English, seem to have produced in these children a sort of 'psychological insulation' to what goes on in school. The passive and unresponsive habits thus established have remained their characteristic reaction to school. A solution of the language problem early in the child's school career would thus seem to be an essential first step for the proper education of these children. Not only test performance, but also the general intellectual development which the tests are designed to gauge, are seriously handicapped by the attitudes and intellectual habits resulting from the child's early linguistic confusion.

It may be of interest to reexamine the findings of Dunklin (16) and of Armstrong et al. (2) in the light of the present results. The subjects in the Dunklin study were first-grade children and were attending a special section taught in Spanish. Thus these children had not yet developed the passive, unresponsive attitudes characteristic of the older school children. Rapport was also better because the teacher, as well as the examiner, spoke to them in the more familiar Spanish. Under these conditions, Dunklin found no inferiority to the American norms on three of the tests. The inferiority on the Spanish translation of the Pintner-Cunningham may be attributed to the fact that the Spanish which the children had acquired in their own homes failed to provide the type of vocabulary required to understand psychological test instructions. In the Armstrong et al. study, which was conducted on fourth- to sixth-grade children, consistently poor scores were obtained on both verbal and performance tests. Although no language was employed on the performance test, the inferiority of the Puerto Rican children on this test was probably due partly to poor rapport in the testing situation and partly to the cumulative effects of four to six years of unsuitable schooling.

**SUMMARY**

The Cattell Culture Free Intelligence Test, Forms 2A and 2B, was administered to 176 Puerto Rican children in grades six to eight of a parochial school in the Spanish Harlem area of New York City. One half of the group received the test instructions in English during the first testing session (Form A) and in Spanish during the second session (Form B); the order of the languages was reversed for the other half of the group. The
split-half reliability of Forms A and B in the English and Spanish versions ranged from .84 to .92. Speed played a negligible part in the scores obtained.

An analysis of variance was conducted on 108 of the subjects, including twenty-seven boys and twenty-seven girls in each of the two language-order subgroups. Significant F-ratios were found for two variables, subjects and session, and for the interaction of order X sex. The most conspicuous finding was the marked improvement from first to second testing session, regardless of language. Although there was no over-all sex difference in score, the girls performed better when the testing order was Spanish-English, the boys when it was English-Spanish. This order X sex interaction was attributed principally to rapport, the more highly Americanized boys responding more favorably to an initially English-speaking examiner, while the more restricted and less acculturized girls achieved better rapport with an initially Spanish-speaking examiner.

The over-all performance of the present group fell considerably below the test norms reported by Cattell. Among the reasons for such a discrepancy are the very low socio-economic level of the Puerto Rican children, their bilingualism which makes them deficient in both languages, their extreme lack of test sophistication, and their poor emotional adjustment to the school situation. In so far as this maladjustment itself appears to have arisen from the children’s severe language handicap during their initial school experiences, a solution of the language problem would seem to be a necessary first step for the effective education of migrant Puerto Rican children.

REFERENCES


5) E. M. Barke and D. E. P. Williams. "A further study of the


