Level I and Level II Abilities in Three Ethnic Groups

Arthur R. Jensen

Am Educ Res J 1973 10: 263
DOI: 10.3102/00028312010004263

American Educational Research Journal
Fall 1973, Vol. 10, No. 4, Pp. 263-276

Level I and Level II Abilities in Three Ethnic Groups [1]

ARTHUR R. JENSEN

University of California, Berkeley

A large battery of various tests of intelligence, scholastic achievement, and short-term memory was administered to some 2,000 white, Negro and Mexican-American pupils in grades, 4, 5, and 6 in a largely agricultural school district in the central valley of California. The three grades were used as separate replications of the study. Factor analysis (i.e., principal components) with oblique rotation yielded three main factors, identified as fluid (g_f) and crystalized (g_c) intelligence (both are aspects of Level II ability in Jensen's theory) and a memory factor (a Level I ability). Mean factor scores for the three ethnic groups differed significantly and showed significant interactions with ethnicity largely in accord with expectations from Jensen's two-level theory of abilities. The white and Negro groups differed markedly in g_c and g_f but not in memory; the white and Mexican groups differed markedly in g_c, and much less in g_f and memory. The Negro and Mexican groups differed the most in g_f but only slightly in g_c. There were also systematic ethnic group differences in the pattern of intercorrelations among factor scores, and in the correlations of the factor scores with an index of socioeconomic status. The results are discussed in relation to Jensen's two-level theory of mental abilities and Cattell's theory of fluid and crystalized intelligence.

[1] This research was supported by grants to the University of California from NIMH and the Sterling Morton Charitable Trust. The writer expresses appreciation to Dr. Wade Egbert, who supervised the testing and data collection, and to Dr. Carol Treanor, who assisted in the statistical analysis.

The two-level theory of mental abilities has been described in detail elsewhere (Jensen, 1968, 1970a, 1970b; 1973, pp. 196-293). Essentially, the theory posits a fundamental psychological distinction between two broad classes of mental abilities, called Level I and Level II. Level I involves the simple registration, storage, and recall of sensory inputs and is most prominent in short-term memory and rote learning. Individual differences in Level I ability have been measured by tests of short-term memory, such as digit span, and by paired-associate and serial rote learning, free recall of random familiar objects, pictures, or words, and trail-and-error selective learning. Level II involves mental manipulation of sensory inputs, relating them to stored memories, and generalization, abstraction, transfer, reasoning, conceptualization and problem solving. It is much like Spearmen's *g*. Individual differences in Level II ability have been measured by standard tests of intelligence, especially tests of fluid intelligence, and by experimental conceptual learning tasks.

It has been hypothesized that Level I and Level II abilities have a distinct genetic basis, as well as being functionally interrelated in a hierarchical fashion such that Level II processes have some degree of dependency upon Level I, but not the reverse. The functional dependence of Level II upon Level I, however, is probably only slight, in view of recent evidence (Jensen, in press). The correlation between Levels I and II in any given population is considered more a result of there existing a genetic correlation between the abilities which has come about through selection and assortative mating. Thus, theoretically almost any degree of correlation between the two kinds of abilities is possible, within the broad limits set by the rather low degree of functional dependence of Level II on Level I. Population groups that have developed under different selective pressures for different abilities, and through historic, geographic, and relative social isolation from one another, might therefore be expected to differ in Level I and Level II abilities and to show differences in the degree of correlation between Levels I and II.

Evidence from previous studies (reviewed in the references cited above) indicates that socioeconomic status (SES) and, to a greater extent, racial groups show differences in Level I and Level II abilities, and differences in the degree of correlation between Levels I and II. Briefly, SES and race (white-Negro) differences have been found to be markedly greater on Level II than on Level I abilities; and the correlation between Levels I and II is greater in middle SES than in low SES groups, and in the white than in the Negro population. While these relationships have been supported by a number of studies, their generality is not yet certain, and it is necessary to study them in a variety of different populations. Since all studies heretofore have been conducted in the highly urbanized white and Negro school populations of the greater San Francisco bay area, in which there are especially marked SES contrasts between racial groups, the present study sought to determine if essentially the same relationships of Levels I and II to race and SES showed up in a quite different school population, viz., an agricultural community in the central valley of California.

METHOD

Subjects

Some two thousand *S*s constituting a representative sample of the school district's elementary school pupils were selected, with the classroom as the

unit of selection, in such a way as to sample roughly equal numbers of the district's white, Negro, and Mexican-American pupils. The white population is mostly middle and lower middle class by most of the conventional criteria for SES classification. The Negro population is lower-middle and lower. The Mexican-Americans, with the exception of a very small percentage of middle and upper-middle class, is by far the most socioeconomically disadvantaged as assessed by the usual criteria for SES. The median education of the Mexican-American parents is between 6 and 7 years, and many have had no formal education whatever. Most of the adult males are employed as field hands; many are itinerant crop pickers. Moreover, English is spoken exclusively in only about 16 percent of the Mexican-American homes in this district. By way of showing the average intellectual and SES characteristics of the three ethnic groups, Table 1 gives the Lorge-Thorndike verbal and nonverbal IQs and scores on Gough's Home Index, a measure of SES described in more detail in the following section. It can be seen that the white school population is very close to the national average in IQ, according to the Lorge-Thorndike norms, with a mean IQ = 100, σ = 16. The Negro group, as is typical of the general Negro population of California, is slightly but significantly above the national average for U.S. Negroes (IQ, about 85). No satisfactory nationwide normative data exist for Mexican-Americans, but other studies, such as the large-scale Coleman report (Coleman et al., 1966) typically find the Mexican-American mean located somewhere between the white and the Negro means on tests of scholastic aptitude, and this is what we see in Table 1. On the Home Index, an SES measure, the white and Mexican groups are separated, on average, by more than a standard deviation, and the Negroes are more or less intermediate.

The *N*s are somewhat smaller for the Home Index, since it became impossible to give all *S*s this questionnaire because of protests in the community which arose after the testing was underway. It is doubtful that this misfortune introduced any systematic bias in the results on the Home Index. Most of the testing had been completed before the public protests

TABLE 1

Mean Lorge-Thorndike Verbal IQ and Nonverbal IQ, and Mean Score on Gough's Home Index, in Three Ethnic Groups

		Verbal IQ			*Nonverbal IQ*		*Home Index*		
Grade	*Group*	*N*	$\overline{X}$	*SD*	$\overline{X}$	*SD*	*N*	$\overline{X}$	*SD*
	White	237	100.85	14.60	108.61	16.05	113	13.11	3.87
4	Negro	189	88.03	11.27	92.33	14.20	129	11.64	3.12
	Mexican	239	89.76	12.17	99.84	14.57	145	8.55	2.84
	White	242	101.83	13.87	110.07	14.93	144	14.09	3.88
5	Negro	198	87.36	11.38	93.79	13.25	132	11.38	3.67
	Mexican	211	89.65	13.11	99.47	14.77	135	9.50	3.20
	White	219	100.93	13.09	110.22	12.89	131	13.90	4.05
6	Negro	169	90.35	12.58	97.99	14.64	124	12.00	3.17
	Mexican	218	90.44	13.79	101.87	14.63	126	8.38	2.81

against the use of the Home Index had been taken note of by the school administration.

Tests

Lorge-Thorndike Intelligence Test, Verbal and Nonverbal (Level 3, Form B): a well-known standardized test of verbal and nonverbal intelligence. The reading level required by the verbal test is considerably below the reasoning demands made by the test items, so that reading ability per se accounts for less of the variance in grades 4 to 6 than is accounted for by a *g* factor common to a variety of intelligence tests, both verbal and nonverbal. The nonverbal test requires no reading and involves reasoning based entirely on figural materials, much like Cattell's Culture-Fair Tests of *g*.

Speed and Persistence: a short test which always precedes the Lorge-Thorndike. *S*s are to make a cross mark (X) in 300 printed squares for two periods of 90 seconds each, first without, and then with, motivating instructions to work as fast as possible. It serves as a warm-up for the Lorge-Thorndike test which follows it immediately, and it also serves to screen *S*s who are not making an effort or complying with the requirements of the testing situation.

Raven's Colored Progressive Matrices: a nonverbal reasoning test devised to measure the *g* factor and minimize variance on group factors and special abilities such as verbal and numerical ability. It is generally regarded as one of the most culture-free or culture-fair tests of reasoning ability. The test is administered without time limit, and *S*s were encouraged to attempt every problem, with no penalty for guessing.

Figure Copying Test: developed at Yale's Gesell Institute of Child Study, and consists of ten geometric forms of regularly increasing complexity which the *S* must simply copy. There is one form per page of the 10-page test booklet; *S* is instructed to copy each form as nearly like the model as possible, attempting all figures without time limit. The test has been used as a measure of school readiness (Ilg and Ames, 1964), and in factor analyses it appears to be a rather purely *g*-loaded test. Each drawing is scored on a 3-point scale according to its approximation to the essential features of the model.

Stanford Achievement Tests: a set of standardized tests of specific scholastic achievement appropriate for grades 4 to 6. The subtests are, Word Meaning, Paragraph Meaning (reading comprehension), Spelling, Language (grammar, punctuation, etc.), Arithmetic Computation, Arithmetic Concepts, and Arithmetic Applications.

Memory for Numbers: a set of three tests of auditory short-term memory, found in past studies to be a good measure of Level I ability. The entire test, which takes about half an hour, is administered by means of a tape recording which presents digit series of from four to nine digits at a one-second rate. After each series, the *S* writes as many digits as he can recall on a specially prepared answer sheet. The score is the number of digits recalled in the correct position. There are three scores, one for each subtest. The subtests consist of immediate recall, delayed recall (a 10-second interval is interposed between the presentation of the series and the time of writing the answer), and repeated series (each digit series is repeated three times prior to recall). The maximum score on any one of the subtests is 39, i.e., the sum of the digit series from four through nine.

Listening-Attention Test: given in the same voice by tape recorder, always preceding the Memory for Numbers Test. It makes no demands on memory but only on the ability to listen attentively and follow instructions. It serves both as a warm-up for the memory test and as a means of screening *S*s who are not up to taking the memory test, for whatever reason. Virtually all children in regular classes in Grades 4 to 6 obtain near-perfect scores on the Listening-Attention test. Also, each subtest of Memory for Numbers is preceded by an easy practice test of three-digit series which helps to insure that all *S*s have understood the requirements of the test that immediately follows.

Home Index: a 24-item questionnaire about the home environment (Gough, 1949, 1971). It is filled out by the child. The items are intended to provide a sensitive composite index of the overall socioeconomic and cultural level of the child's family background. The items fall into four categories: Part I reflects primarily the educational level of the parents; Part II reflects material possessions in the home; Part III reflects the degree of parental participation in middle or upper-middle class social and civic activities; Part IV relates to formal exposure to music and other arts. One other item was added to the SES index, based on school records, namely, whether the child's family is on welfare. This dichotomous item had a significant and substantial correlation (−.40) with the total score on the Home Index in the entire sample.

Procedure

All tests were administered in late fall on different days for each test, but within a one-week period for any given class, with the exception of the Stanford Achievement Battery, which was administered within a one-week period in late spring. Approximately half the sample (selected randomly with the classroom as the unit of selection) were tested by a staff of specially trained testers, and half were tested by their regular classroom teachers. Separate parallel analyses for testers and teachers were run on all the data, which were then combined for the present analyses, since they showed no systematic or significant differences with respect to the present variables.

RESULTS

Since it would be most cumbersome to perform separate analyses on each test with respect to the hypotheses under consideration, it seemed decidedly preferable to factor-analyze the entire battery and work with a few main factor scores rather than with a large number of scores on various tests. Also, since the same tests were administered in Grades 4, 5, and 6, the three grade samples could be considered independent replications of each analysis and of the tests of the main hypotheses. Therefore data from the three grades were never combined for any analysis, but were treated as three independent replications of the study.

All the analyses were based on the raw scores, and age in months was partialled out of all the intercorrelations among the variables prior to the extraction of factor scores. Thus, none of the observed effects in any of the analyses can in any way be attributed to group differences or interactions of test variables with chronological age.

Oblique Factor Scores

Intercorrelations among all the ability and achievement tests within each racial group within each grade were subjected to a principal components analysis, and the components with eigenvalues greater than one were then rotated to oblique simple structure by means of the promax method (Hendrickson & White, 1964). The same three factors unambiguously emerge in each ethnic group and at each grade level, which justifies performing the same kind of analysis on the three ethnic groups combined within grade levels. Factor scores derived from the oblique factors for the combined ethnic groups permit group comparisons on each of the factors. Oblique rotation, of course, allows there to be correlated factors, and the factor structure which emerges is not artificially forced on the data. Three distinct factors emerged. Two of them must be regarded as types of Level II ability and the third as Level I. The first two factors correspond closely to what Cattell (1971, ch. 5) has referred to as crystalized and fluid intelligence, abbreviated as g_c and g_f, respectively, to represent these two aspects of the general intelligence factor, g. Since these two factors in the present analysis are practically identical to Cattell's g_c and g_f, we will adopt these labels henceforth. Both, it should be noted, are Level II abilities. Level I ability is represented by the third factor which loads highly on the memory tests. Table 2 shows the oblique factor loadings.

TABLE 2

Oblique Factor Loadings in Combined Ethnic Groups in Grades 4, 5 and 6[a]

	Factor I (g_c)			*Factor II* (g_f)			*Factor III* (*Memory*)		
	Grade			*Grade*			*Grade*		
Tests	*4*	*5*	*6*	*4*	*5*	*6*	*4*	*5*	*6*
Lorge-Thorndike Verbal	64	53	81	15	16	05	04	10	02
Lorge Thorndike Non-verbal	18	16	32	62	57	45	02	00	07
Raven's Matrices	09	08	06	93	93	77	02	08	02
Figure Copying	14	15	13	91	91	80	05	08	01
Memory-Immediate	03	02	05	03	01	07	87	81	81
Memory-Repeated	00	05	03	06	06	13	88	87	93
Memory-Delayed	03	06	07	04	08	17	90	79	77
Listening-Attention	09	14	32	12	10	08	08	08	03
Making Xs, 1st Try	01	03	04	03	02	04	07	00	01
Making Xs, 2nd Try	06	01	01	07	03	02	01	02	01
Stanford Achievement:									
Word Meaning	91	84	96	10	14	13	04	13	04
Paragraph Meaning	89	95	96	07	10	05	05	06	02
Spelling	95	84	93	10	09	20	11	06	01
Language	88	69	82	02	21	08	01	05	05
Arithmetic Computation	50	57	56	15	04	22	07	03	05
Arithmetic Concepts	65	78	76	16	01	14	04	15	02
Arithmetic Applications	75	76	81	07	15	12	03	11	01

[a] Decimals omitted.

Factor scores were derived from the oblique factors for all *S*s within each grade, and for each of the three factors the scores were standardized to $\mu = 100$, $\sigma = 15$.

Mean factor scores on g_c, g_f, and Memory of the three ethnic groups in each of grades 4, 5, and 6 are shown in Figure 1. (The *N*s in the various groups are given in the first column of Table 1.) Analysis of variance within each grade was used to test the significance of the main effects for ethnic groups and the interaction of groups and abilities; both the main effect and the interaction were significant beyond $p < .001$. On crystalized intelligence, g_c, whites scored markedly higher than Negroes and Mexicans, who are similar in g_c. On fluid intelligence, g_f, whites and Negroes are even further apart, while Mexicans are intermediate. On Memory (Level I), the white and Mexican groups are furthest apart and Negroes are intermediate. In accord with previous findings, the Level II abilities (i.e., g_c and g_f) show much greater ethnic group differences (particularly white-Negro differences) than is found on Level I ability, in which the white and Negro groups come especially close together. As can be seen clearly in Figure 1, the pattern of factor scores for the three ethnic groups is closely replicated in every grade. Thus, the hypothesis that Level I and Level II abilities interact with population groups, and that low SES and middle SES groups differ more on Level II than on Level I, is borne out by these results, most clearly in the case of the white-Negro differences. The results of the Mexican group are less unequivocal with regard to the hypothesis, which suggests that the hypothesis applies more to the white-Negro racial difference rather than to their SES difference per se. The Mexican group is the most disadvantaged by a number of SES criteria, yet they differ from the white group on g_f only half as much

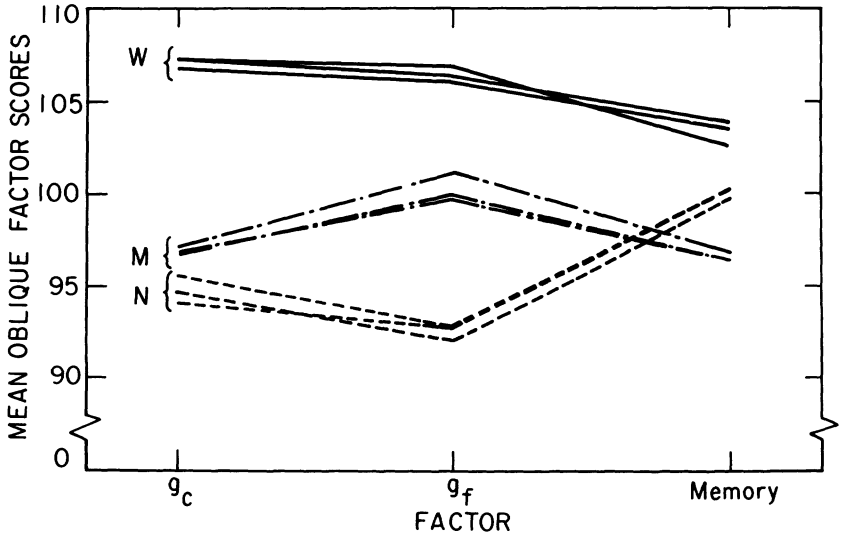

Figure 1
Mean Oblique Factor Scores for Crystalized Intelligence (g_c), Fluid Intelligence (g_f), and Memory in White (W), Negro (N), and Mexican (M) Groups Plotted Separately for Grades 4, 5, and 6

as does the Negro group; and g_f is a more pure measure of Level II than g_c. The lower scores of the Mexican group on the verbally loaded g_c may be understood in large part in terms of their Spanish-speaking or bilingual home backgrounds. Whether their lower scores on the memory factor is related to language background is not known, but it should be noted that the three ethnic groups did not differ significantly on the Listening-Attention test. It would be interesting to test for Level I in the visual modality as well as the auditory. The group means might have a different rank order with visually presented digits (see Jensen, 1970). This remains for future investigation.

Orthogonal Factor Scores and Control of SES

In order to determine if the pattern of abilities for the three ethnic groups shown in Figure 1 is attributable more to SES than to ethnicity, variance on the Home Index (including welfare status) was partialled out of the matrix of correlations, which in effect statistically equates the ethnic groups on SES, in so far as SES is measured by the Home Index and welfare status. Thus, the pattern of intercorrelations, and consequently the factor structure, are rendered independent of the effects of SES.

Further, in order to test the hypothesis with respect to independent, i.e., uncorrelated, factor scores, the three principal components were orthogonally rotated to the varimax criterion. The varimax factor scores, therefore, are free of the SES effects assessed in the Home Index, and, by virtue of their orthogonality, permit examination of the group differences on each factor when the ethnic groups have been statistically equated on each of the other two factors. In other words, we are asking how much the groups differ on each of the three factors independently of their differences on the other two. Figure 2 shows these results. (Grand $\mu = 100$, $\sigma = 15$; the Ns in the various groups are given in the sixth column of Table 1.) We see that the picture is highly similar to Figure 1, but all of the differences and similarities between groups on the various abilities appear somewhat sharpened or exaggerated, and they clearly replicate from one grade to another. (The same factor labels are retained, although, of course, the orthogonal factors are not perfectly correlated with the oblique factors and therefore, technically speaking, are not exactly the same factors. The degree of similarity, however, is so high as not to warrant re-naming the three factors.) Scheffe contrasts following the analysis of variance show no significant differences between whites and Mexicans on g_f or between whites and Negroes on the memory factor. These results accord with the hypothesis for Negroes for both forms of Level II, g_c and g_f, but in the Mexican group the hypothesis holds only for g_c. If we accept g_f as the more pure and more culture-free measure of Level II, it would appear that the Mexican group differs hardly at all from the white group with respect to the hypothesis, despite the fact that it differs the most in cultural and SES background. Thus the interaction of Level I–Level II with population groups must be regarded as mainly a difference between whites and Negroes, rather than a difference in SES.

Correlations Between Oblique Factor Scores

Since the two-level theory of abilities posits essentially different and independent genotypic underpinnings for Levels I and II which may become genetically and phenotypically correlated through selection and functional

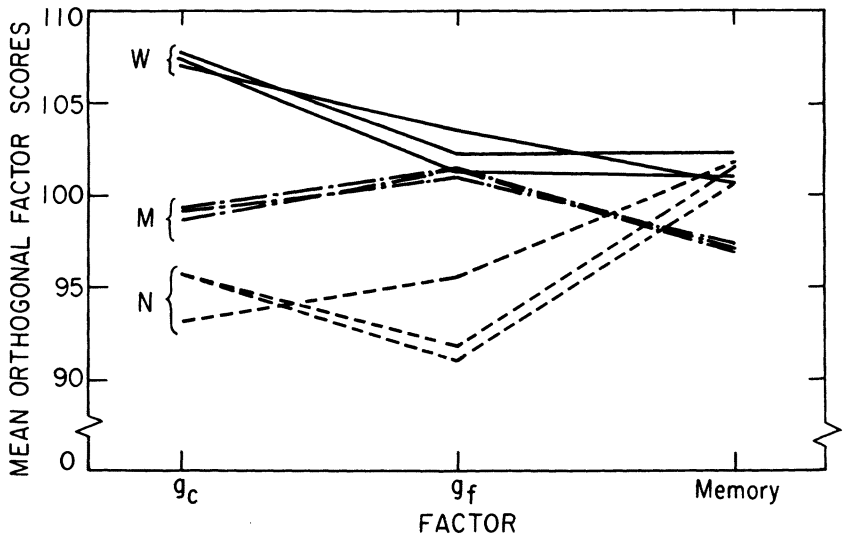

Figure 2
Mean Orthogonal Factor Scores for Crystalized Intelligence (g_c), Fluid Intelligence (g_f), and Memory in White (W), Negro (N), and Mexican (M) Groups Plotted Separately for Grades 4, 5, and 6, with SES Statistically Controlled

interdependence of the two kinds of ability, a corollary of this is the possibility that the amount of correlation between Level I and Level II may differ in various populations which historically have differed in selection pressures, the basis for assortative mating, the degree of social and occupational stratification, and the like. Previous studies generally have found that the correlation between Level I and Level II tests is higher in the white than in the Negro population (Jensen, in press). There is evidence in earlier studies that the same correlational differences exist for middle and lower SES groups within a given ethnic group (e.g., Rapier, 1968), but more recent and larger investigations have made this conclusion doubtful or at least ambiguous (Green & Rohwer, 1971; Jensen, in press). Aside from whatever the causes of population differences in correlations may be, it is first of all important to establish empirically the authenticity of such differences.

The oblique factor scores should allow a good test of the hypothesized population differences in correlations between Level I and Level II. Correlations (Pearson r) between the factor scores were obtained within each ethnic group within each grade. These rs were transformed to Fisher's $z_r = 0.5\ ln\ [(1 + r) / (1 - r)]$ for testing the significance of the differences and for graphical presentation, as shown in Figure 3. z_r is preferable for graphical presentation because, unlike Pearson r, z_r is an interval scale, so that differences in terms of σ_z units are directly comparable in different regions of the scale. (The corresponding values of Pearson r may be read off the ordinate on the right. The Ns in the various groups are given in the sixth column of Table 1.)

The pattern of correlations is highly consistent, with the one exception of the correlation between g_f and memory in Grade 4. The only apparent

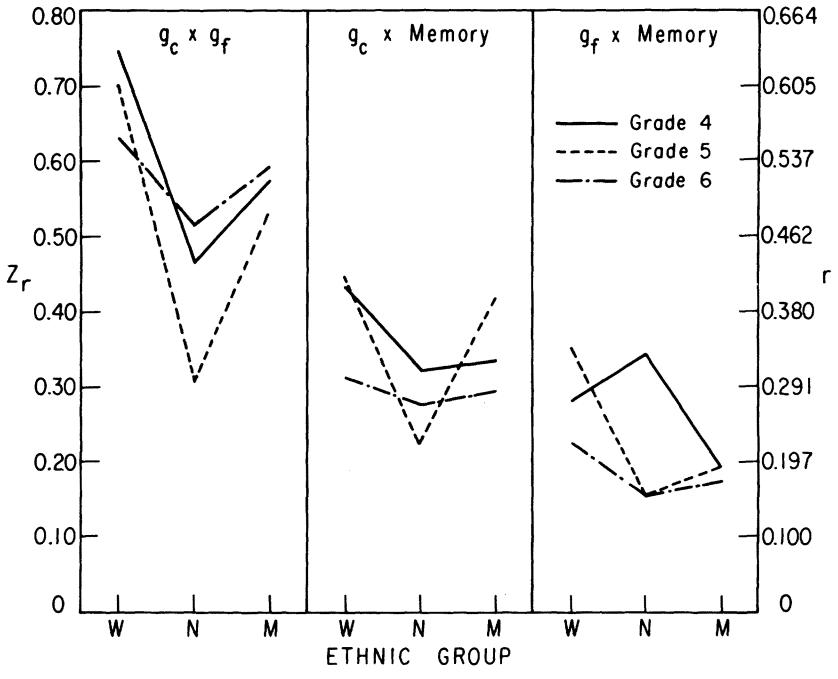

Figure 3

Fisher's z_r Transformation of Pearson r for Correlations among Oblique Factor Scores for Fluid and Crystalized Intelligence (g_f and g_c) and Memory in White (W), Negro (N), and Mexican (M) Groups at Grades 4, 5 and 6

explanation for this deviation is sampling error. In all other cases the pattern of correlations for whites and Negroes is consistent with previous findings, that is, a higher correlation between Level II (g_c and g_f) and Level I (memory) in the white group than in the Negro group. The correlations in the Mexican group are consistently more or less intermediate. Thus, in correlations as well as in mean scores, the Mexican group is less dissimilar from the white group than is the Negro group, despite the apparently greater cultural and socioeconomic disparity between the white and Mexican groups. A one-tailed statistical test of the correlational differences shown in Figure 3, based on the combined grades, shows significant white-Negro differences on $g_c \times g_f$ ($p < 10^{-6}$), and on $g_c \times$ Memory ($p < .014$). The white-Mexican differences are significant only on $g_c \times g_f$ ($p < .01$) and $g_f \times$ Memory ($p < .03$). The Mexican-Negro difference is significant only on $g_c \times g_f$ ($p < .01$).

The fact that the same ethnic pattern of correlations holds also for the correlation between g_c and g_f raises the question whether this correlational pattern is really a more general phenomenon, of which the two-level theory is merely one instance. Do Negroes show lower intercorrelations among various test scores in general than do whites, after taking account of test reliability and range-of-talent? A previous study which corrected for attenuation and range-of-talent still found highly significant differences between Level I and

Level II tests. Prior analyses revealed no significant or appreciable ethnic group differences in split-half and equivalent forms reliability of the various tests entering into the present factor scores. Ethnic group differences in the degree of correlation among various traits in general is a relatively unexplored territory. It would have implications for any kind of educational or job selection based on test results. Selection of persons on the basis of one measured trait also means incidental selection on other correlated traits, and therefore, even with an identical selection cut-off score across all populations, other criterion-relevant traits would differ in various populations that have different patterns of intercorrlations of the various traits. For example, from Figure 3 it is evident that selection on g_c would pull along with it a higher degree of incidental selection on g_f in the white group than in the Negro group. Fair assessments of individuals from various populations would therefore seem to depend upon the use of multiple selection criteria and a broad inventory of measured abilities.

Relationship of Factor Scores to SES Within Ethnic Groups

Past accounts of the two-level theory have posited a lower correlation of SES with Level I than with Level II. Just as the white-Negro difference is less for Level I than for Level II, it was hypothesized that the difference between lower and higher SES groups is less for Level I than for Level II. Rapier (1968) presented evidence for this interaction of SES and Levels I and II within a white population. Green and Rohwer (1971), however, reported findings which appear equivocal regarding the predicted interaction within a Negro sample divided into lower, lower middle, and middle SES. The predicted interaction showed up for one Level I test (paired-associates learning), but not for another (digit span), which showed just as large SES differences as a Level II test (Raven's Matrices). Jensen (in press), on the other hand, found high and low SES groups to differ almost twice as much on a Level II test (Lorge-Thorndike IQ) as on a Level I test (Memory for Numbers), both in white and Negro populations, when these were stratified into three SES groups on the basis of parent's occupation.

The question can be investigated with the present data simply by correlating the oblique factor scores with the Home Index within each ethnic group. Since previously cited studies suggest that the ability scores do not have a linear regression on SES, it is advisable to measure the degree of relationship between factor scores and the Home Index by means of the correlation ratio, η, which can reveal nonlinear as well as linear regression of the factor scores on the SES index. The obtained values of η are given in Table 3.

We see that the ηs are all rather surprisingly low, except for g_c and g_f in the white group. Also, one might have expected a higher correlation for g_c than for g_f, but just the reverse was found. As for our hypothesis that Level II should be more highly related to SES than Level I, we find consistent and significant evidence in support of the hypothesis only in the white group, in which the correlation of g_f and g_c with SES differs significantly ($p < .01$) from the correlation of Memory with SES. In the Negro and Mexican groups the hypothesized interaction of Levels I and II with SES is not consistently borne out and the effects are nonsignificant ($p > .05$) in all cases.

TABLE 3

Correlation Ratio (η) of Oblique Factor Scores on Gough's Home Index in White (W), Negro (N), and Mexican (M) Groups[a]

	g_c			g_f			*Memory*		
Grade	*W*	*N*	*M*	*W*	*N*	*M*	*W*	*N*	*M*
4	387	187	185	455	315	119	225	235	153
5	422	216	277	530	193	124	232	238	141
6	294	187	335	501	165	193	164	138	261
Combined	377	197	269	498	225	144	209	211	193

[a] Decimals omitted.

DISCUSSION

This study, using a different methodology based on factor scores, clearly replicates the main findings of previous studies with regard to white-Negro mean differences in Level I and Level II abilities and the interaction of abilities with race. The predicted pattern of correlations between Levels I and II, viz, a higher correlation in the white than in the Negro population, was also borne out, although not as impressively. Finally, consistent and significantly different correlations of Levels I and II with SES were found only in the white group. The Negro and Mexican groups evinced surprising and rather uniformly low correlations of all three of the ability factors and the measure of SES. This disparity in SES correlations in the white group on the one hand, and in the Negro and Mexican groups on the other, is not attributable to ethnic group differences in variances or reliabilities of the Home Index. It is more likely due to differential validity of the Index in the three groups, at least as regards correlations of SES and ability. Variation in the below-average range of the Home Index, where the vast majority of Negroes and Mexicans are distributed, may be less highly related to ability differences than variation in the above-average range, where a substantial proportion of the white population is found. A highly detailed examination of the relationship of the Home Index to aptitudes and achievement in the three ethnic groups, using multiple regression analyses, is planned as a separate study.

The inclusion of the Mexican group in the present study adds to the evidence that Level I-Level II interacts more with white-Negro differences than with SES per se, since the Mexican group, which is culturally and socioeconomically the more different from the white group, actually differs less from the white group on the Level II measures, especially g_f, than does the Negro group. The same is true of the correlations between abilities, especially $g_c \times g_f$.

Since the two-level theory essentially hypothesizes independence of Level I and Level II abilities, which become correlated at the genotypic level through genetic selection and at the phenotypic level through some degree of

functional interdependence (especially the dependence of some types of Level II performance upon Level I processes), it is fully consistent with the theory to find different degrees of correlations between Levels I and II and different patterns of mean differences in various populations.

It is important to distinguish between the essential aspects of the theory, namely, the independence of Levels I and II, and the empirical manifestations of the theory in various populations. The validity of the theory, on the one hand, and the generality of certain population differences in Level I and II, on the other, are essentially different questions, in the same way that the law of falling bodies and the particular value of the gravitational constant are separate questions. The present study supports the essential two-level theory in so far as it demonstrates population differences (both in means and intercorrelations) in the two classes of ability, and it further substantiates the empirical findings of other studies regarding the white-Negro interaction with Levels I and II.

The two-level theory is not at all in conflict with Cattell's (1971) theory of fluid and crystalized intelligence, but, in a sense, is actually "orthogonal" to it. Fluid and crystalized abilities can be either Level I or Level II. For example, g_c and g_f are both Level II abilities in the two-level theory, and the present Memory factor and the g_f factor are both fluid abilities in Cattell's theory. Both theoretical distinctions, Level I-Level II and fluid-crystalized, seem conceptually valid and are consistent with empirical findings.

REFERENCES

Cattell, R. B. *Abilities: Their structure, growth, and action.* Boston: Houghton-Mifflin, 1971.

Coleman, J. S., *et al. Equality of educational opportunity.* Washington, D.C.: U.S. Office of Education, 1966.

Gough, H. G. A short social status inventory. *Journal of Educational Psychology,* 1949, *40,* 52-56.

Gough, H. G. A cluster analysis of Home Index status items. *Psychological Reports,* 1971, *28,* 923-929.

Green, R. B., & Rohwer, W. D., Jr. SES differences on learning and ability tests in black children. *American Educational Research Journal,* 1971, *8,* 601-609.

Hendrickson, A. E., & White, P. O. Promax: A quick method for rotation to oblique simple structure. *British Journal of Statistical Psychology,* 1964, *17,* 65-70.

Ilg, F. L., & Ames, L. B. *School readiness: Behavior tests used at the Gesell Institute.* New York: Harper & Row, 1964.

Jensen, A. R. Patterns of mental ability and socioeconomic status. *Proceedings of the National Academy of Sciences, U. S.,* 1968, *60,* 1330-1337.

Jensen, A. R. Hierarchical theories of mental ability. In B. Dockrell (Ed.), *On intelligence.* Toronto, Canada: Ontario Institute for Studies in Education, 1970. Pp. 119-190. (a)

Jensen, A. R. A theory of primary and secondary familial mental retardation. In N. R. Ellis (Ed.), *International review of mental retardation.* Vol. 4. New York: Academic Press, 1970. Pp. 33-105. (b)

Jensen, A. R. Individual differences in visual and auditory memory. *Journal of Educational Psychology,* 1971, *62,* 123-131.

Jensen, A. R. *Genetics and education.* New York: Harper & Row, 1973.

Jensen, A. R. Interaction of Level I and Level II abilities with race and socioeconomic status. *Journal of Educational Psychology,* in press.

Rapier, J. L. The learning abilities of normal and retarded children as a function of social class. *Journal of Educational Psychology,* 1968, *59,* 102-119.

(Accepted June 1973)

AUTHOR

JENSEN, ARTHUR R. *Address:* Institute of Human Learning, University of California, Berkeley, California 94720. *Title:* Professor of Educational Psychology. *Degrees:* B.A., University of California, Berkeley; M.A., San Diego State College; Ph. D., Teachers College, Columbia University. *Specialization:* Human learning, mental measurement, individual differences.