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Intelligence, Learning Ability and Socioeconomic Status

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The research and theory presented here originated in the observation that low IQ children called "culturally disadvantaged" appear in certain ways to be considerably brighter than their more advantaged middle-class counterparts of similar IQ.

We know that on standard intelligence tests, like the Stanford-Binet, the Wechsler scales, and group tests intended to measure the same abilities, children of low socioeconomic status (SES) perform almost one standard deviation below the general population mean, and upper-middle class children about one standard deviation above it (Tyler, 1965, Chap. 13).

Two theories have been formulated to account for these differences in the distribution of IQ as a function of SES.

The first theory holds that SES differences in IQ are due entirely to environmental or social-cultural influences (e.g., Eells, Davis, Havighurst, Herrick, & Tyler, 1951). According to this view, SES differences in measured intelligence do not have a biological basis, but reflect only the degree of cultural bias that exists in the tests, which are devised by middle-class persons, and standardized and validated on largely middle-class populations.

The second theory holds that SES differences in measured intelligence do reflect cultural differences to some degree; but they also reflect genetically-determined differences in potential for intellectual development (e.g., Burt, 1959, 1961).

Most of the evidence supports the conclusion that the first theory is inadequate, and that the second theory is essentially correct. The conclusion that SES intellectual differences have a major genetic component, and are not entirely attributable to environ-

1 Based on a paper presented at a symposium on "New Approaches to the Measurement of Intelligence," at the annual convention of the American Educational Research Assoc., Chicago, Feb. 8, 1968.

ment, is now practically beyond dispute among scientists who have studied the relevant evidence, which comes from a variety of sources (Tyler, 1965; Burt, 1959 and 1961; Eckland, 1967; Jensen, 1968 a and b). For example, identical twins separated in the first year of life, and reared in widely differing social classes, show greater resemblance in intelligence than unrelated children reared together (Burt, 1966); the IQs of children adopted in early infancy show a much lower correlation with the SES of the adopting parents than do the IQs of children reared by their own parents (Leahy, 1935); the IQs of children reared in orphanages from infancy, who have not known their parents, show approximately the same correlation with their true father's occupational status as do children reared by their own parents (.23 vs. .24) (Lawrence, 1931); the correlation between the IQs of children adopted in infancy and the education of their true mothers is close to that of children reared by their own mothers (.44), while the correlation between children and their adopting parents is close to zero (Honzik, 1957); children of both low and high SES show, on the average, an amount of regression from the parental IQ toward the mean of the general population that is precisely predicted by a polygenic model (Burt, 1961); when full siblings (who have, on the average, at least 50% of their genetic inheritance in common) differ significantly in intelligence, those who are above the family average tend to move up the SES scale, and those who are below it tend to move down (Young & Gibson, 1965).

Psychologists, educators, and sociologists have made intensive efforts to devise "culture-free" or "culture-fair" tests that would eliminate SES differences in measured intelligence; none of these efforts has succeeded (Lambert, 1964; Ludlow, 1956). There are no standard intelligence tests known which eliminate SES differences.

Then what about the common observation that, in some ways, low-SES children with low IQs appear brighter than middle-class children of the same IQ? Is this only because standard IQ tests are culturally biased so as not to give a true picture of the disadvantaged child's intellectual ability?

Direct learning tests

To study this phenomenon, we decided to measure children's learning abilities directly, by giving them something to learn and seeing how fast they succeeded. Many disadvantaged children with IQs of 60 to 80 showed a level of ability on these learning tests that would be entirely unexpected from their low IQs or their poor scholastic achievement. The children's learning performances, however, often correspond to the classroom teacher's judgment of the child's brightness as observed on the playground or in social situations. On the other hand, upper-middle-class children in the same IQ range (60 to 80) performed on the learning tasks in a way that was consistent with their low IQs and poor scholastic performances—they were consistently slow learners in a wide variety of situations.

The learning tasks were varied: serial and paired-associate rote learning (Jensen, 1961; Jensen & Rohwer, in press; Rapier, 1968), selective trial-and-error learning (Jensen, 1963), and free recall (Jensen, 1961), all using a variety of materials and methods of presentation. Our most recent work utilizes the digit span paradigm, which seems to be the purest measure of the learning-ability factor measured by the other learning tests, and which shows the same interaction between IQ and SES as the other tests (see Jensen, 1968a, pp. 20-21).

Our subjects have been low-SES children (typically called culturally disadvantaged) and middle- and upper-middle-class children, as determined by the neighborhood of their home and their father's occupation. Their ages ranged in various studies from preschoolers to junior high school pupils, that is, from about ages four to 14. Mexican-American, Negro, and Caucasian populations have been sampled. Low-SES children in each of these groups were much alike, on the average, with respect to the phenomena here described.

Essentially the same results have been found so consistently with various learning tasks, different age groups, and different ethnic samples, that there can be little doubt that we are studying a substantial psychological phenomenon.

The essential results of these studies are summarized in Figure 1. Note the large average difference in learning ability between the high- and low-SES groups in the low IQ range. But also note that in the above-average range of IQ, the high- and low-SES groups do not differ appreciably in learning ability, as measured by our learning tests. (The slight difference between low- and high-SES groups of above-average IQ shown in Figure 1 is probably due to statistical regression, since the low-SES groups with IQs above 100 are above the general mean of all low-SES children).

A related fact is that the learning tests show quite different correlations with IQ in the low-SES and middle-SES groups. In the low-SES groups, correlations between the learning tests and IQ are in the range from .10 to .20. The correlations for middle-class children for various tests range between .60 and .80, which is about as high as the intercorrelations among various standard IQ tests. In other words, our learning tests could substitute for IQ tests in the middle-class segment of the population, but not in the lower-class segment.

These SES differences in correlation are not attributable to SES differences in the variance on either the learning or the IQ tests; nor are they attributable to SES differences in test reliability. They are not due to any psychometric cause, as far as we can determine. This is a genuine phenomenon, calling for further analysis and theoretical explanation.

Examination of the correlation scatter diagrams for the two SES groups is revealing. The general finding is shown schematically in Figure 2, which illustrates the locus of the SES difference in the magnitudes of the correlation between associative learning ability and IQ.

Another interesting finding results when a number of learning tests and intelligence tests are intercorrelated and subjected to factor analysis separately in low- and middle-SES groups. The general factor common to all tests accounts for a much larger proportion of the total variance in the middle-SES than in the low-SES groups. (This finding was markedly apparent in a comparison of low-SES Negro children with middle-SES Caucasian children).

Two dimensions of SES differences

These results do not readily lend themselves to explanation in terms of greater cultural bias in the IQ tests

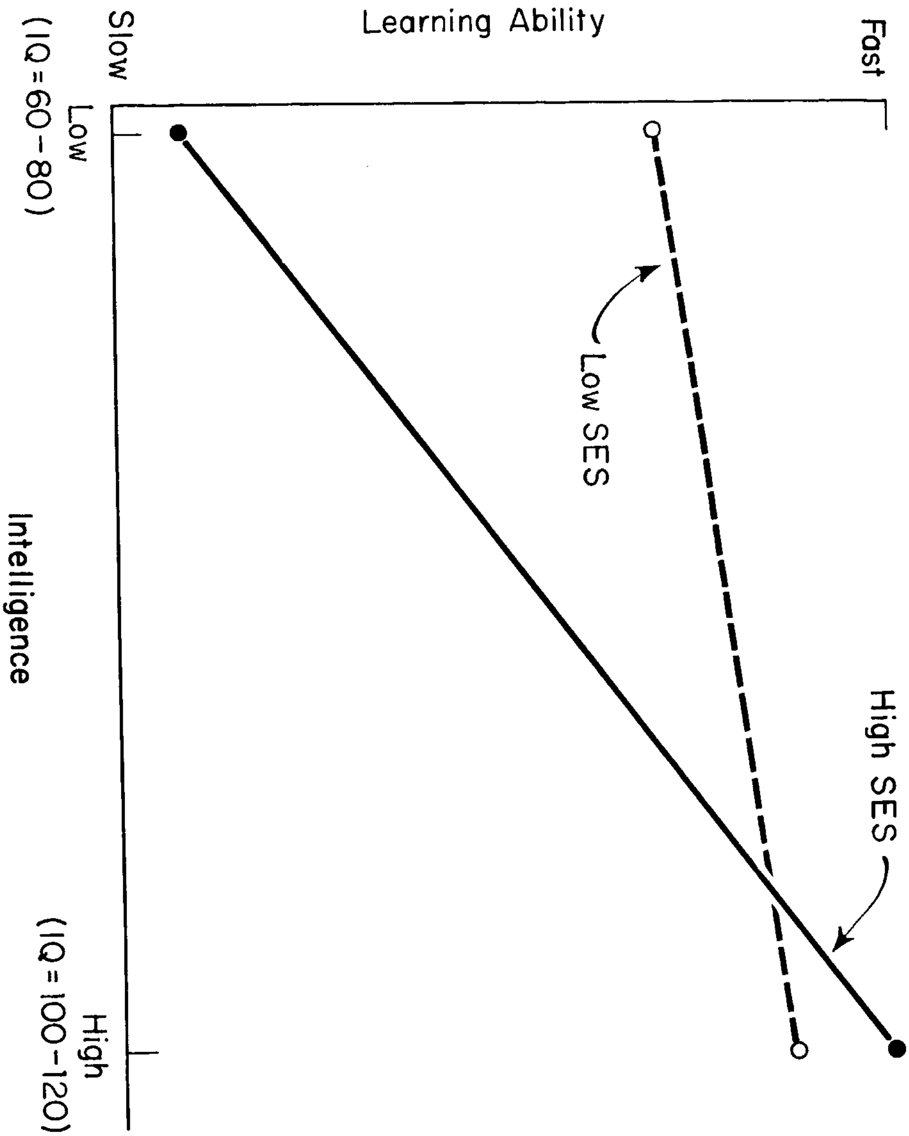

Fig. 1. Summary graph of a number of studies, showing the relationship between learning ability (free recall, serial and paired-associate learning, and digit span) and IQ as a function of socioeconomic status (SES).

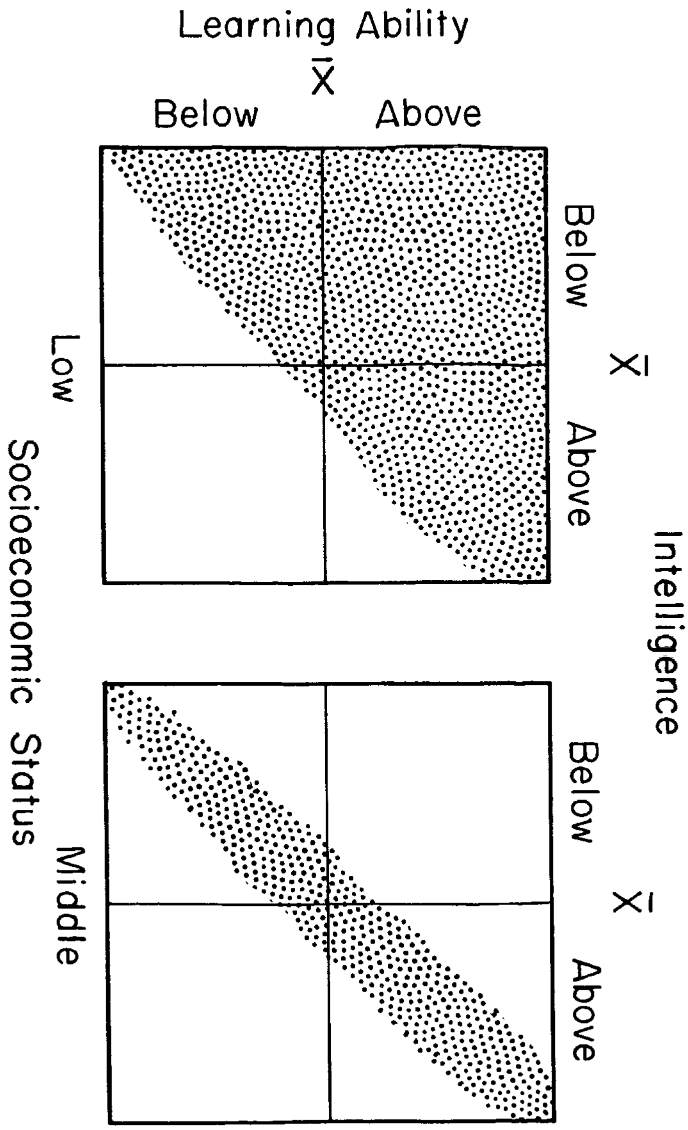

Fig. 2. Contingency tables illustrating the essential form of the correlation scatter-diagram for the relationship between associative learning ability and IQ in low-SES and upper-middle-SES children.

than in the learning tests. A more complex formulation is needed to explain these results, as well as a number of other findings reported in the literature – findings which appear paradoxical if one thinks in terms of cultural bias in tests as the sole explanation of SES differences in test performance.

For example, culturally disadvantaged children often perform better on verbal than on non-verbal intelligence tests. By what rationale can one call the non-verbal tests more culturally biased than the verbal? Negro children perform much better on the digit span test than on the vocabulary test of the Stanford-Binet (see Jensen 1968a, pp. 20-21; Kennedy, Van De Riet & White, 1963). Is this only because vocabulary is more culturally loaded than digit span? Then why do Negro children do worse on Raven's Progressive Matrices than on the Stanford-Binet (Higgins & Sivers, 1958; Sperrazzo, & Wilkins, 1958 and 1959)? Also, several studies have shown that Negro youths performed better, relative to whites, on intelligence test items judged to be cultural, than on items judged to be non-cultural (McGurk, 1951; Dreger & Miller, 1960, pp. 366-7).

Findings such as these lead to the conclusion that another dimension, in addition to the cultural loading of tests, must be hypothesized in order to comprehend all the relevant facts.

We cannot discard the concept of culture-free vs. culture-loaded tests. This is a real and useful continuum, which should not be abandoned just because no existing tests of intelligence fall at either end of it. Various tests stand at different points on this continuum. Much of the discouragement of attempts to devise culture-free tests has resulted from the choice of the wrong criteria for determining the degree of "culture-freeness" of a test. Those who chose as the criterion the degree to which the test minimized social class differences have utterly failed (e.g., Ludlow, 1956; Lambert, 1964). They have produced either tests having meager correlations with other measures of intelligence, even in culturally advantaged segments of the population, or tests which, on cross-validation, do not reduce SES differences in IQ.

The proper criterion for the "culture-freeness" of a test is the magnitude of heritability estimates that can be obtained for the test in a specified population. The higher the heritability (h^2), the less culturally or environmentally biased is the test for the population in which the determination of h^2 is made. The magnitude of h^2 tells us the extent to which the test is measuring something that is genetically determined. (For a discussion of the meaning and computation of h^2, see Jensen, 1967 and 1968a).

Intelligence test items can, of course, be classified, by factor analysis or related techniques, in many categories or dimensions (Guilford, 1967). The two dimensions we are hypothesizing as minimally necessary for comprehending the phenomena we have just described may be tentatively designated as *cultural loading* and *complexity of learning tasks*. Theoretically, these two dimensions are best thought of as completely orthogonal (uncorrelated), although their manifestations in actual test items may necessarily be correlated.

Little more need be said about the cultural-loading dimension at this point *(see Fig. 3)*. It is defined by the value of h^2 (heritability estimate) for

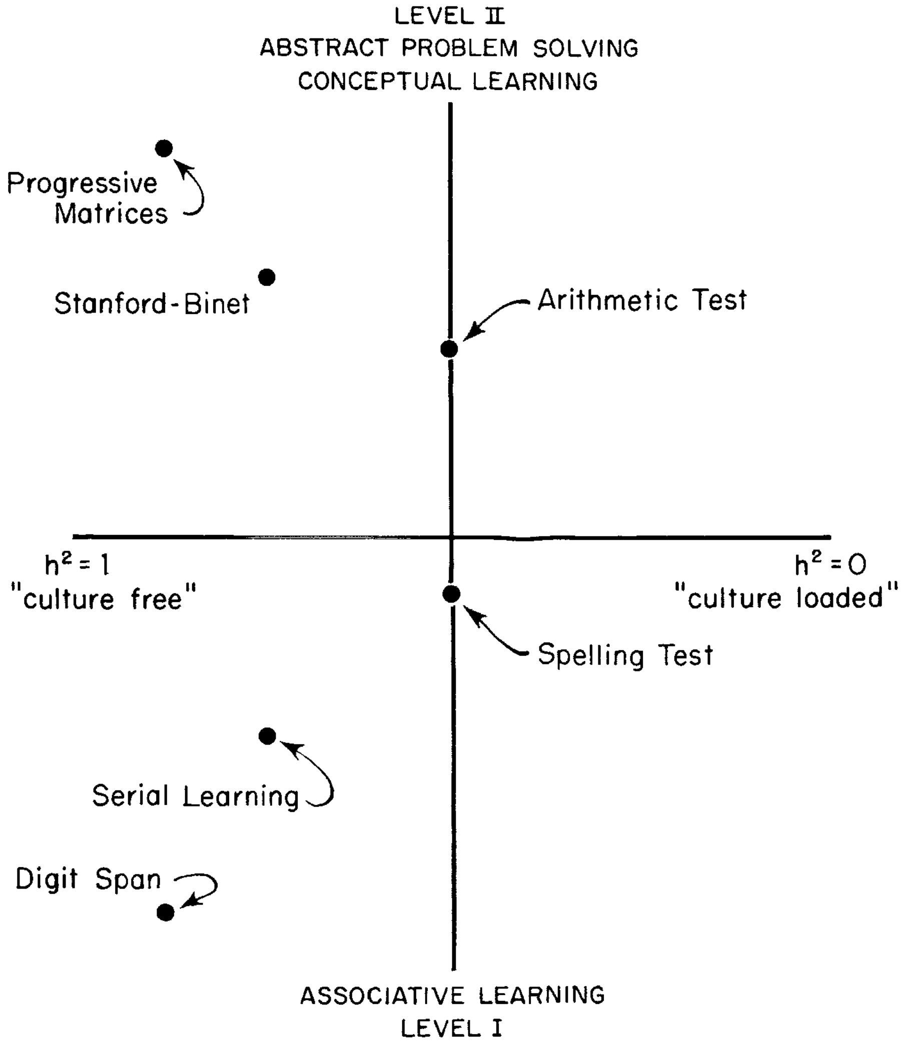

Fig. 3. The two-dimensional space required for comprehending social-class differences in performance on tests of intelligence and learning ability. The locations of the various tests in this space are speculative.

the test in a given population. Research on social-class and race differences in abilities can be aided by taking greater account of this dimension. Group comparisons should be made on two or more tests that stand at distinctly different points on this continuum for each of the groups being compared. Differences between the group means on the various tests should be plotted and studied as a function of h^2.

The second dimension, *complexity of learning tasks,* orthogonal to cultural loading, is more difficult to describe, partly because its nature is still being elucidated in our current research.

As depicted on the vertical axis in Figure 3, it represents a continuum of tests ranging from memory span and associative learning at the one extreme to conceptual learning, abstract reasoning and problem solving at the other. Near one end of this continuum are such tests as digit span, serial rote learning, paired-associate learning and free-recall. These tests stand at different points on the continuum, but they are all in the region below the horizontal axis in Figure 3. At the other extreme of the continuum are tests such as the Progressive Matrices, the Dominoes test, analogies tests, verbal similarities, and tests of the speed of concept attainment.

Another way of characterizing this test dimension would be in terms of the amount of self-initiated activity required of the testee. As we move up from the digit span test to the Progressive Matrices, for example, the subject must spontaneously bring more and more covert "mental" activity (discrimination, generalization, verbal mediation, deduction, induction, and hypothesis testing) to bear on the task in order to perform successfully.

The increasing complexity of the processes required for noting of the tasks in the second dimension may be thought of as hierarchical—the more complex processes being functionally dependent upon the "simpler" or more basic ones. Consequently, individual differences in test performance along this continuum should be asymmetrically correlated between tests of lower and higher levels. Poor performance at a lower level is sufficient cause for poor performance at a higher level, while good performance at a lower level is necessary but not sufficient for good performance at a higher level.

A minimum hypothesis

At the present stage of our research on this problem we are proposing the simplest possible model—a minimum hypothesis—to attempt to comprehend our findings and the related evidence in the literature *(op. cit.).*

The hypothesis states that the continuum of tests going from associative to conceptual is the phenotypic expression of two functionally dependent but genotypically (or structurally) independent types of mental process, which we shall label Level I and Level II. Level I processes are perhaps best measured by tests such as digit span and serial rote learning; Level II processes are represented in tests such as the Progressive Matrices.

(1) The biological or structural basis of Levels I and II are thought of as independent (although they are functionally related, since the rate and asymptote of phenotypic development of Level II performance depends upon the individual's status on Level I processes). For example, short-term memory is necessary for solving Progressive Matrices, but the covert mediation and abstraction needed for them are

not necessary for digit span performance. The individual's performance on Level II tasks cannot rise much above the limitations set by his abilities on Level I. Conversely, high status on Level I cannot express itself in Level II performance higher than the individual's ability on Level II functions.

(2) Level I and Level II processes are distributed differently in the upper and lower social classes. Level I is distributed fairly evenly in all classes, while Level II is distributed about a higher mean in the upper classes than in the lower *(see Fig. 4)*. (The exact form of the distributions is not a crucial point in the present discussion.)

Our empirical findings can be explained by three hypotheses: (a) the genotypic independence of Level I and Level II processes, (b) the functional dependence of Level II upon Level I, and (c) the differential distribution of individual differences in Level I and Level II genotypes in upper and lower social classes, as shown in Figure 4. (The terms *genotype* and *phenotype* are used very loosely, not in a strict genetic sense, in order to distinguish between test performance and the psychological or structural processes underlying performance.)

Type A children, who are above average on Level I but below average on Level II performance, usually appear to be bright and capable of normal learning and achievement in many life situations, although they have unusual difficulties in school work under the traditional methods of classroom instruction. Many of these children, who may be classed as mentally retarded in school, suddenly become socially adequate persons when they leave the academic situation. Type B children, who are far below average on both Level I and Level II, seem to be much more handicapped. Not only is their scholastic performance poor, but their social and vocational potential also seem to be much less than those of children with normal Level I functions. Yet both type A and type B children look much alike in overall measures of IQ and scholastic achievement. This is a major shortcoming of our traditional testing procedures. Tests which clearly assess and distinguish between Level I and Level II abilities must be developed for general use in schools, clinics, personnel work, and the Armed Forces. Also, instructional methods which make better use of Level I abilities must be sought as a means of improving the educational outcome of children now called culturally disadvantaged.

Determinants of Level I and Level II

Level I abilities may be less affected by environmental deprivation than Level II abilities, since the distribution of Level I seems to be about the same across all SES and racial groups.

The extent to which Level II is dependent upon the quality of the environmental input is an open question. It could be composed of an acquired set of cognitive abilities. The rate and asymptote of their acquisition could be viewed as a joint function of inherited Level I ability and the quality of the environment. According to this view, individual differences in Level II could have no genetic component, other than that included in Level I abilities. This seems rather unlikely, however, considering the high heritability of Level II tasks such as the Progressive Matrices. Some of our current research is aimed at finding the answer to this question. We are especially interested in finding children who by all criteria come from a good

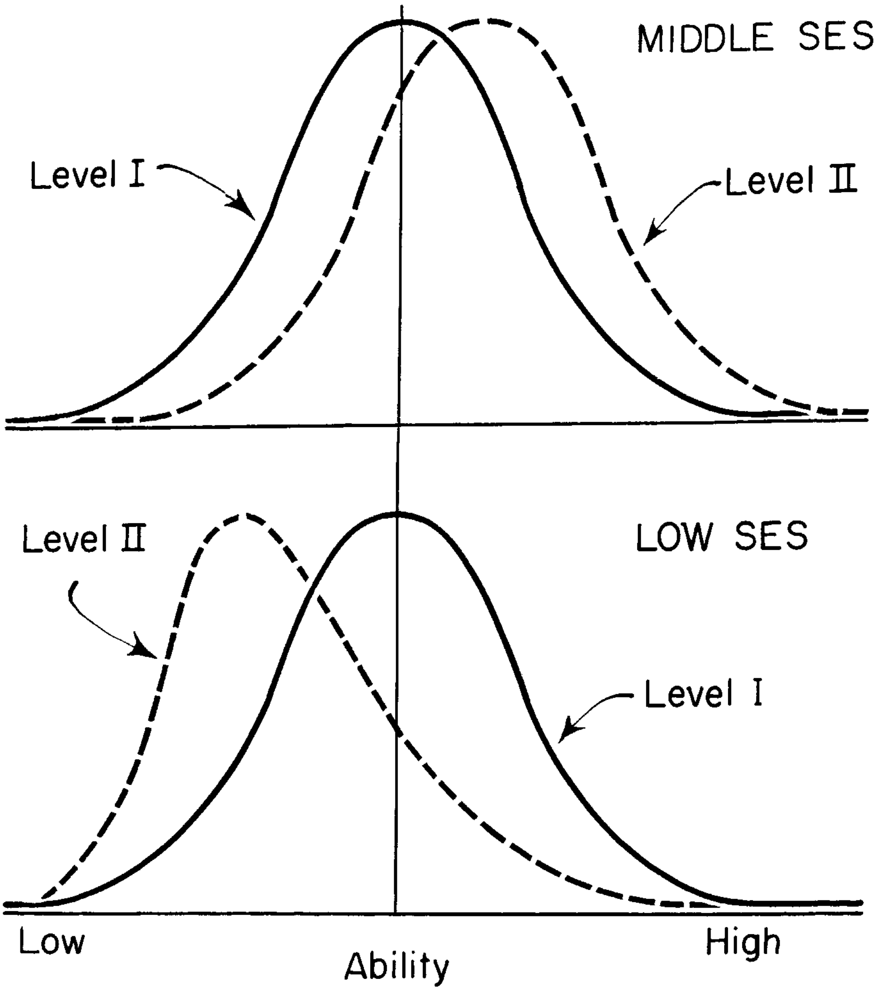

Fig. 4. Hypothetical distributions of Level I (solid line) and Level II (dashed line) abilities in middle-class (upper curve) and culturally disadvantaged (lower curve) populations.

environment, yet who show essentially the same pattern of Level I and Level II abilities which is typical of children from poor environments. If Level II is not genotypically independent, then we should not find low Level II performance (ruling out brain damage, test anxiety, etc.) in the presence of superior Level I ability plus superior environment.

Growth curves of Level I and Level II

An ancillary hypothesis concerns the growth functions of Level I and Level II measures *(see Fig. 5).* These hypothetical curves are inferred from certain empirical findings which we have reviewed in some detail elsewhere (Jensen, in press). Memory span and serial learning ability, for example, rapidly approach their asymptote in childhood and soon level off, while Progressive Matrices performance increases slowly throughout childhood and into early adulthood. This formulation is also consistent with the pattern of correlations between intelligence test scores at early and later ages (Bloom 1964, chap. 3).

The different forms of these two growth functions in middle- and lower-class children would also account for the so-called "cumulative deficit" phenomenon (the relative lowering of IQ and scholastic achievement) often found in culturally disadvantaged children as they progress from early childhood to maturity (Jensen, 1966).

Group vs. individual testing

We have found that caution must be observed in obtaining and interpreting test results from low-SES children. It appears from recent findings in our laboratory that middle-class children perform about the same on Level I learning tasks whether they are tested individually or as a group in the classroom (the rest of the testing procedure being identical). Lower-class children, on the other hand, seem to perform considerably worse in the group situation than when tested individually. We have now begun to investigate this phenomenon in its own right. It may be crucial for the development of standard procedures for assessing the learning ability of disadvantaged children.

SUMMARY AND CONCLUSIONS

Low-SES children with low measured IQs (60 to 80) are generally superior to their middle-class counterparts in IQ on tests of associative learning ability: free recall, serial learning, paired-associative learning, and digit span. Low-SES children of average IQ or above, on the other hand, do not differ from their middle-class counterparts on these associative learning tasks. This interaction among IQ, associative learning ability, and socio-economic status has been found in groups of children sampled from Caucasian, Mexican-American, and Negro populations.

The findings have been interpreted in terms of a hierarchic model of mental abilities, going from associative learning to conceptual thinking, in which the development of lower levels in the hierarchy is necessary but not sufficient for the development of higher levels.

The findings are important because they help to localize the nature of the intellectual deficit of many children called culturally disadvantaged; they bring a sharper focus to the nature-nurture problem as it relates to social class and racial differences in mental ability; they show that environmental deprivation does not have an equal effect on all mental abilities; and they emphasize the need for standard tests to assess a broader spectrum of mental abilities than is sampled by current tests of intelligence.

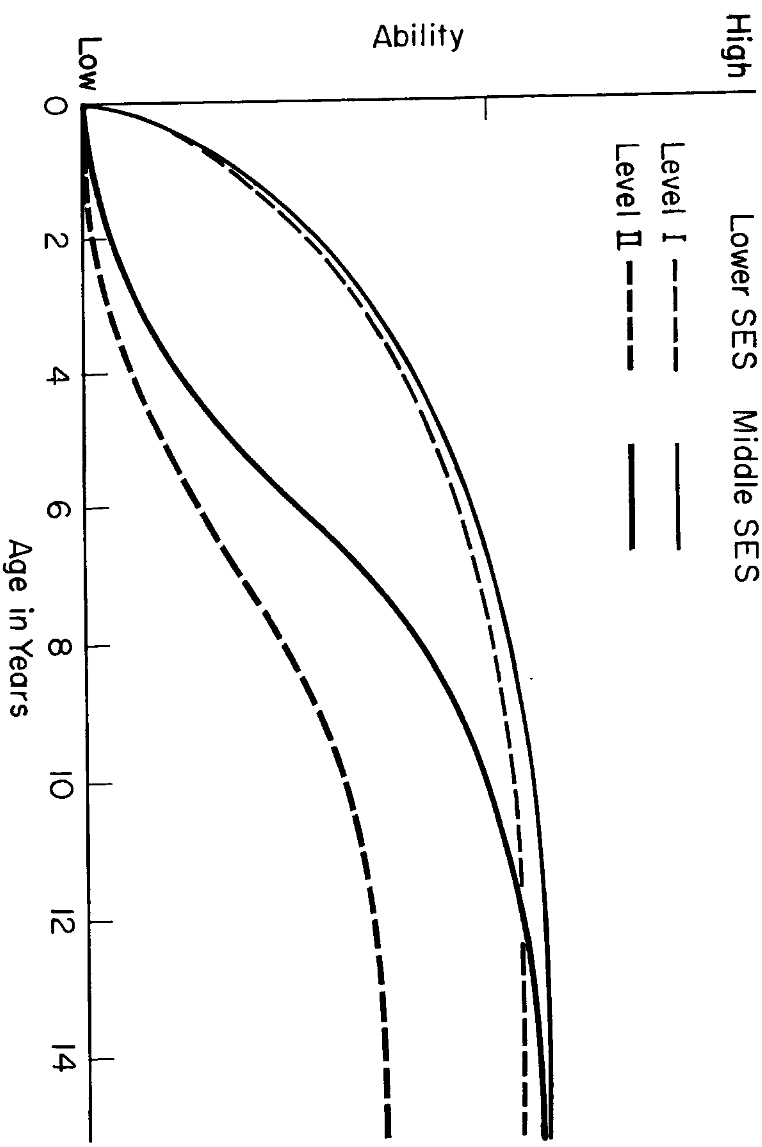

Fig. 5. Hypothetical growth curves for Level I and Level II abilities in middle-SES and low-SES populations.

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