1977

Factors Associated with Intellectual Development: Birth Order and Family Size Effects for a Select Population

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FACTORS ASSOCIATED WITH INTELLECTUAL DEVELOPMENT:
BIRTH ORDER AND FAMILY SIZE EFFECTS
FOR A SELECT POPULATION

by
William M. Schaefer

A Dissertation Submitted to the Faculty of the Graduate School
of Loyola University of Chicago in Partial Fulfillment
of the Requirements for the Degree of
Doctor of Philosophy

February
1977
ACKNOWLEDGMENTS

The author wishes to thank all the members of the dissertation committee: Dr. Jack Kavanagh, Dr. Steven Miller, and Dr. Pedro Saavedra all of whom contributed to the ultimate completion of this task. Particular gratitude goes to the committee Director, Dr. Joy Rogers who has been a continuing source of encouragement as well as a model for academic excellence.

Additional thanks go to James M. Jordan, superintendent of the Cook County Juvenile Temporary Detention Center, without whose understanding and cooperation this task would have been considerably more difficult.

Most importantly I wish to express my gratitude to my wife, Deanne, to whom, and with whom, all things are possible.
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CHAPTER I

INTRODUCTION

The present research is intended to investigate the significance of family related variables, specifically family size and birth order, in relation to verbal and performance abilities of a selected population.

Zajonc (1975), in analyzing data from a study by Belmont (1973), has developed a confluence model which attempts to explain observed effects of birth order and family size on the test performances of a group of nineteen-year-old boys. The Ss were virtually all of the male, surviving, children born in the Netherlands between 1944 and 1947. The Ss were evaluated by taking a Dutch version of the Raven Progressive Matrices.

The results of the Belmont (1973) study indicate that birth order and family size have independent effects on intellectual performance. Effects of birth order were consistent across social classes as divided into nonmanual, manual, and farm workers, but the effects of family size were not present across all social class levels.

Birth order effects demonstrated a strong linear relationship on a decreasing scale from first to last born. However, there was one anomaly in these data. Only-born children did not score the highest, but had a mean score comparable to the first born of a four-child family (see Figure 1).
In general, family size had a negative effect on Raven performance when analyzed independent of birth order (i.e., third-borns of four-child families compared to third-borns of five-child families). However, the relation of family size to Raven performance was more pronounced in the manual and nonmanual as opposed to the farm groups. For the farm group there was little systematic relation to level of Raven performance for the various birth order positions.

Zajonc (1975) notes that, except for only and last borns, intelligence and birth order are related by a quadratic function. The Confluence Model explains the variations by pointing out that neither the only or the last born child serves as an intellectual resource for his siblings. The only because he has none, and the last because he is the youngest and will not have information about which the older children are unaware.

The concern of this study is whether the Confluence Model is generalizable to other populations. There is related research to suggest that the Confluence Model may be of limited utility particularly where minority races and groups are concerned. According to Zajonc (1975), the Confluence Model is based entirely on the mutual intellectual influences among children as they develop in the family context. The major emphasis therefore is on the intellectual environment during the course of their development.

While the family constellation may be an important contributor to intellectual development, other variables (see topographical outline, Figure 1) as genetics (i.e., Dobzhansky, 1947; Lewontin, 1974; Loehlin, 1975; Sanday, 1972), race (i.e., Montagu, 1975; Lieberman, 1968; Green, 1972; Nei, 1974), nutrition (i.e., Knobloch, 1956; Harrel, 1965;
Figure 1

Model of Intellectual Development

Down's Syndrome
Conception Gene Interaction
Gene Prenatal Birth 0-2
PKU

Race
Genes Genes Genes

Diet
Stress
Physical
Psychological

Mother-child Interaction
Mother's Race
Care by Mother

Motivation Extrinsic
Intrinsic

Identification with
Competition with

Peers

Turner's Syndrome

Race

Family Orientation

SES begins to Correlate

Environment

Stimulation

Family

Teachers

School

Curriculum

Test Reliability

Variables

Test Comparisons

Performance Content

Verbal Content

Cultural Loading

Validity

IQ TEST GIVEN

12

Cumulative Personality

Transient Factors

Intellectual

Non-Intellectual

Personality

Race Sex

Administrator

Non-Extrinsic

Integrative

Care by with

Mother

Mother's Peer's

Race (Intrinsic)
family interaction (i.e., Munsinger, 1974; Golden, 1971; Bronfenbrenner, 1972; Eyferth, 1961; Belmont, 1973),
culture (i.e., Shubert, 1972; Wilson, 1973; Cleary, 1968), SES (i.e.,
Mayeske, 1973; Lesser, 1965; Jensen, 1969), motivation (i.e., Wienges,
1971; Cass, 1968; Fast, 1967; Devlin, 1971), school (i.e., Coleman,
1966; Gay, 1973; Anderson, 1972; Hausman, 1973), peers (i.e., Coleman,
1966; Gay, 1973; Katz, 1964), tests (i.e., Darlington, 1971; Willard,
1968; Halpern, 1974; Jorgensen, 1973) and personality (i.e., Schmideberg,
1969; Gibby, 1967; McClelland, 1973; Vera, 1971), have been shown to be
relevant for a child in the process of intellectual growth.

While a genetic or physiological explanation for the effects of
birth order or family size on intelligence is not precluded, the
Confluence Model hypothesizes a primarily environmental position. Birth
order is seen as relevant to the intellectual environment of which each
sibling is not only a part, but to which he or she also contributes.
Hence, not only is birth order, but family size, and the distances
between siblings, considered potentially meaningful to the child's
overall intellectual growth.

Zagonc acknowledges that the family constellation is only a part
of the total environmental influence that contributes to intellectual
growth, but he believes that for purposes of "gross analysis" it is
sufficient to consider the interdependence among the children's intel-
lectual levels and nothing more. While he does not make specific
reference to other populations, there is the clear implication that he
expects the Confluence Model to be applicable to more than just 19-year-
old males from the Netherlands, but this requires assumptions about
consistencies in environmental experiences which, according to the research to be cited, is untenable.

It is well documented that intelligence, as measured by test performance, is not fixed but increases significantly till about early adolescence (Golden, 1971; Luria, 1961; Piaget, 1952). To the extent that one accepts a position that the environment influences intellectual growth, the need to recognize variations in the environment, and their resultant effect on individuals and populations, becomes crucial. The Confluence Model must be evaluated subject to the validity of its assumptions. A necessary assumption of this model is that the general environmental contribution, apart from the family constellation, across populations is equivalent. If the proportion of variance for the general environment is not the same for groups other than those studied by Belmont (1973), the effects of the family constellation may be significantly different.

When considering the proportion of variance that may be accounted for by the environment, heritability (which is discussed at length in Chapter II) questions may help to illustrate the problem. Jensen (1969) hypothesizes the genetic contribution of intelligence to be about .80 leaving the remaining .20 for the environment. Salapatek (1971) believes that the genetic contribution for middle class whites is .40 while for blacks it is .25. The implication of this research is that blacks have a more restricted environment and are unable to make use of their genetic potential.

A restricted environment theory may account for some of the observed differences between blacks and whites in overall IQ (i.e., Kaufman, 1972; Kresheck, 1973; Oakland, 1971), as well as research which
indicates that blacks do significantly better on performance than verbal tests (i.e., Jensen, 1969; Mercer, 1972; Holowinsky, 1972; Kaufman, 1973).

The contrast between performance and verbal abilities becomes apparent between 18 and 24 months of age (Kagan, 1969; Bayley, 1965; Honzik, 1957). Golden (1971) suggests a shift occurs between the pre- and verbal levels of intelligence. Verbal ability is more closely associated with different SES levels (see Chapter II) and environmental influences than is performance ability. This suggests that limitations in environmental stimulation or range would most significantly affect intellectual skills related to verbal ability.

Zagonc (1975, p. 84), referring to the Raven scores used in the Belmont study, "which is reported to be fairly free from cultural and environmental influences," goes on to state, "We would expect, therefore, that verbal tests would reveal patterns of results that would be even more pronounced than those of Belmont and Marolla."

Research by Altus (1965) supports the above prediction in that birth order effects were found for the verbal but not quantitative scores of University of California students taking the Scholastic Aptitude Test. Research cited by Cicirelli (1967) (Altus, 1966; Corliss, 1964; Hall, 1963; Lees, 1957; Maxwell, 1960; Rosenberg, 1964; Schachter, 1963) shows general support for the Confluence Model in relation to birth order effects. However, several studies cited by Cicirelli (1967) suggest that environmental influences in birth order effects may be time and situation dependent.

When young children have been compared, the birth order effects appear to be reversed. In a study by Able (1964) later-born three-year-
olds were found to be superior to first-borns on the Draw-A-Man test. In addition, Koch (1954) conducted a study in which kindergarten children from two-child families were compared on the Thurstone Primary Mental Abilities Test. In that study the second-borns surpassed the first-born children which is in direct contradiction to the Confluence Model.

Cicirelli (1967, pp. 482-483) makes an important statement relative to the above contradictions, "This may reveal some sort of developmental trend where at an early age the later-born child benefits from the stimulation of an older sibling, and at a later age (where the abstract verbal abilities come into play in the school situation) the first-born child profits from his closer exposure to adults." He cites Altus (1959) to support this theory. In that study illiterate soldiers were given IQ tests and the last borns scored the highest; Cicirelli concludes, "... Here, any predisposition of the first-born to profit from school remained undeveloped."

Based on the above cited research in conjunction with the research review of Chapter II, the present author derives the following theoretical perspective: The first-born children receive the highest percentage of adult attention which tends to promote the acquisition of a predominantly verbal orientation. However, the potential verbal superiority of the earlier born child is not manifest merely through interaction in the family constellation but is a function of environmental and school experiences as well. Given the normal environmental and school experiences of the majority culture, the verbal capacities will be realized resulting in the observed birth order effects of the Belmont (1973) and prior studies. However, in cases where the environment, including the school, does not support or promote the acquisition of verbal skills the
potential advantages of the earlier born children may be lost and the predicted birth order effects of the Confluence Model will not be supported.

Blacks as a group have not done as well on verbally oriented I.Q. tests as they have done on the performance measures. If they suffer from deficiencies in verbal skills through restricted environmental experiences than the potential advantages for the earlier born children will not be manifested and birth order effects will be significantly reduced.

According to census data (Kohn, 1969; Coleman, 1966) Blacks have larger families than whites. This is true even when SES is controlled. However studies of early performance abilities (Bayley, 1965; Honzik, 1957; Golden, 1971) show no significant differences between blacks and whites on performance abilities up to three years of age. Since blacks have greater family size, the necessarily negative effects of family size predicted by the Confluence Model may not be appropriate in assessing performance abilities of blacks.

The effects of family size on intelligence are not clearly determined even in the Belmont (1973) study from which Zagonc (1975) derived the Confluence Model. In the Belmont study the effects of family size were not present in all social classes, being least significant in the farm group. This suggests that the effects of family size on intelligence may be influenced by environmental factors thereby limiting inferences of causality or a direct relation between family size and intelligence.

The theoretical perspective of the author assumes that verbal abilities, while susceptible to birth order effects, are time and situation dependent. The potential manifestation of superior verbal skills
is dependent upon school as well as family related variables. A restricted environment theory assumes a nonsignificant relationship between birth order or family size and verbal skills for a Black population in contrast to the negative effects generally predicted by the Confluence Model.

The Statement of the Problem

This research proposes to identify and evaluate the effects of birth order or family size on the verbal and performance abilities of a selected population of Black, male, juvenile delinquents.

1. **The first subproblem.** The first subproblem is to determine whether there are significant birth order effects on verbal ability for the selected population and, if so, if they differ from prior studies on other populations.

2. **The second subproblem.** The second subproblem is to determine whether there are significant birth order effects on performance ability for the selected population and, if so, how they compare to those predicted by a Confluence Model.

3. **The third subproblem.** The third subproblem is to determine whether there are significant family-size effects on verbal ability for the selected population, and, if so, in what ways they compare to those predicted by a Confluence Model.

4. **The fourth subproblem.** The fourth subproblem is to determine whether there are significant family-size effects on performance ability for the selected population and, if so, in what ways they compare to those predicted by a Confluence Model.
The Hypotheses

Using the Confluence Model proposed by Zagonc, the following hypotheses are derived:

1. There will be significant birth order effects for Black, male, juvenile delinquents on the Vocabulary subtest of the Weschler Intelligence Scale for Children (WISC-R).

2. There will be significant birth-order effects for these subjects on the Block Design subtest of the WISC-R.

3. There will be significant family-size effects for these subjects on the Vocabulary subtest of the WISC-R.

4. There will be significant family-size effects for these subjects on the Block Design subtest of the WISC-R.

Predictions Based on a Restricted-Environment Theory

The present author believes that the subjects to be studied represent a unique subpopulation to whom some of the important assumptions of the Confluence Model may not be relevant. As has been stated in this introductory chapter, and will be supported further by the review of the research, environmental experiences may alter the degree to which genetic potential, relative to intelligence, is manifested. Consistent with a Restricted-Environment theory the following predictions are made relative to the hypotheses of the Confluence Model:

1. Birth order effects for verbal skills may be time and situation dependent. The manifestation of superior verbal ability acquired in the family constellation may depend on the positive effects of school and related experiences. Black children from low SES backgrounds may be
limited in the acquisition of language skills necessary for success in school related situations. Due to the variances in experience between this population and that upon which the Confluence Model was derived, the present author believes that birth order effects will be nonsignificant relative to verbal skills as indicated by performance on the Vocabulary subtest of the WISC-R.

2. Family-size effects appear to be of decreasing significance relative to performance skills, as indicated by the Belmont (1973) study, as SES declines. The subjects of the present study are homogeneous in relation to their parents' occupations. All of the Ss come from homes in which the primary wage earner is either a manual laborer or is on some type of welfare assistance. Because the group tested includes offsprings from homes where the parent's employment is lower than that of white collar or professional groups, it is believed that the declining effects of family-size relative to performance in the Belmont study will be manifested in this population as well. In contrast to the Confluence Model a nonsignificant relationship is expected between verbal and performance abilities, as measured by subtests of the WISC-R, as related to family size for this population.

3. As indicated earlier in the chapter studies have shown less differences between Black and white groups relative to measures of performance than to verbal skills. This suggests a greater similarity of environmental influences relative to acquisition of performance abilities or a greater genetic, hence less environmental, contribution. Consistent with these findings, and in conjunction with the significant birth order effects found in the Belmont (1973) study, the present author
believes that birth order effects on the Block Design subtest of the WISC-R will be significant for this population as predicted by the Confluence Model.
CHAPTER II

REVIEW OF THE RESEARCH

Factors associated with intellectual development will be discussed as they occur in the developmental outline included in the introduction (see Figure 1). Following a discussion of the relevant areas, a study designed to assess the importance of one of these related areas (as considered in Chapter I) will be set forth.

Section One

Race. Section one of the topographical outline concerns itself primarily with genetic factors which may be involved in the development of intelligence. In order to assess whether there are genetic differences between races, the concept of "race" needs to be examined and a working definition that can be used for hypothesis testing has to be reached.

Notions about race differ depending upon whether the orientation of the researcher is biological, historical, anthropological, racist, etc. It can be stated with assurance that the term continues to have relativity of meaning.

While early genetics ascribed to races a homogeneity of genes, it is now apparent that, even in the most strict biological terms, there is no such thing as a pure race. Loehlin (1975, p. 20), states: "Such beliefs are refuted by the identification of identical genes in different races, the genetic heterogeneity of all races, and the fact that
individual genes, not total genotypes, and certainly not phenotypes, are inherited."

Supporting a no-race position Lieberman (1968) cites studies including one on sickle-cell anemia. It is known that one sickling gene gives resistance to malaria and the inheritance of two sickling genes causes anemia and early death. A study of West African populations revealed a series of clines ranging from a population where 29% of the genes are of the sickling type to a population which had none. Classification of groups into "races" must therefore be done with knowledge about its limitations.

Theories which have accepted a race position have been concerned with the sources of genetic variance which separate the groups. Some of these include: mutation, drift, natural selection, and migration. Of these selective migration would appear to have the greatest potential for producing the greatest change between subpopulations. This argument has been used by Eysenck (1971), and others, to support the position that blacks taken into slavery were not representative of the African population, but were at the lower end in factors related to intelligence.

A necessary assumption for this theory is that those who were mentally slower were the ones most likely to be taken as slaves. It is not really necessary to argue against this far-reaching claim because as Loehlin (1975, p. 44) states:

...if large average genetic differences are attributed to selective migration, extremely severe selection must be postulated. To produce a genetic difference of one standard deviation by selecting individuals from a normal IQ distribution, all migrants would have to be selected from only the 15 percent of the population at one extreme. This assumes a fairly high heritability of IQ; if the heritability is lower, the selection must be even more extreme.
Measurements related to black and white differences must be qualified by recognizing that race, in most studies, is determined by morphs (observable characteristics) or self-reports. However, comparison of blood types between African and North American blacks shows that blacks in the United States have about 30% genes from white populations (Lieberman, 1968).

This is contrasted with a much more rigorous definition of "Negro" as indicated in a study by Green (1972). In Puerto Rico an individual has to be almost "full blooded" to be called negro, while in the United States he may be called negro if he has any observable characteristics which are at all negroid.

Some studies have compared differences in blood groupings across races (e.g., Forbes (1971)) and then made statements about intelligence differences in these populations. However, as Thoday (1969) indicates, these comparisons are inappropriate. Comparisons between blood groups do not present a problem because they are discontinuous, however this is not the case for IQ scores. It is not possible to identify specific genotypes for IQ, and there are environmental as well as genetic causes of variation.

Nei (1974, p. 435), in analyzing the relationship between the races using blood and protein group loci indicated, "The racial net condon differences relative to the interracial condon differences was small indicating that the genic variation between the three races (Caucasian, Mongoloid, Negroid) is small compared to that within the same race."

Studies by Osborne (1971), and Loehlin (1973) compared 16 blood group genes on black and white groups to determine whether increased
increased incidence in European genes in blacks would lead to higher IQ scores on three ability factors. Results of both studies were non-significant indicating that, at least for the groups studied, there was no appreciable relation between the 16 blood group genes and performance on ability tests related to IQ.

Assessing the relationships between the amount of white blood in an individual and their measured IQs may appear to be a fruitful method of determining the genetic differences in white and black populations; however, this is not the case. There appears to be significant confounding of race, SES, and culture. In general, those of mixed ancestry tend to be more exposed to western ways and, for U.S. populations, those blacks who have a greater degree of white blood appear to be more assimilated to "white" culture.

**Genetics.** Direct evidence for genetic differences of races re: mental ability is lacking; arguments often have been supported by analogy. References to somatic differences in populations from different countries have been compared to the likelihood that mental traits are equally diverse. However, Dobzhansky (1947, p. 590) states:

Arguments based on analogies are precarious, especially where evolutionary patterns are concerned. If human races differ in structural traits, it does not necessarily follow that they must also differ in mental ones. Race differences arise chiefly because of the differential action of natural selection on geographically separated populations. In the case of man, however, the structural and mental traits are quite likely to be influenced by selection in different ways.

There are some genetic defects which have a direct bearing on the resultant IQ of the individual and from which we may assert that there is at least some unspecified relation between genes and intelligence. Two of the most striking examples of gene-linked intellectual deficits are
Down's syndrome and Turner's syndrome. The manifestations of Down's syndrome are well known, but the effects of the sex-linked disorder are also important in making inferences about the genetic influence on intelligence.

In a dissertation by Caccamo (1972), later reported in *Exceptional Children* (1973), psycholinguistic abilities were compared between Negro and Caucasian children with Down's syndrome. Previous studies had indicated that normal Negro Ss had superiority in auditory sequential memory. This was not demonstrated in comparisons of these groups with Down's syndrome. Additionally these Ss did not differ significantly on ITPA profiles.

Individuals suffering from Turner's syndrome have characteristic features which include a slight appearance, sterility, and, most important re: statements about intelligence, they have problems with spatial ability; while in other respects their IQ's are normal (Osborne, 1971). This suggests that different genes carry different factors associated with specific intellectual abilities.

An hypothesis regarding the possibility of a single gene effect accounting for observed differences in spatial visualization between blacks and white has been suggested by Bock (1973). However, a reference to a study by Eyferth (1966), in Loehlin (1975), provides a reasonably direct challenge to this position. Referring to a study of illegitimate children of German mothers, whose mates were of either race, Loehlin says,

If the gene for spatial ability is X-linked and if the gene is more frequent among the white fathers of these children than among the black fathers, but equally frequent among the two sets of German mothers,... the Caucasian mixed-race
girls should show a difference in spatial ability in favor of the Caucasians ... the data on this study analyzing the performance scales does not support such a position.

Heritability. Jensen's estimations of heritability, based on Burt's (1963, 1966) studies are shown to be as high as .80. Jensen (1969) says: "... look at unrelated children reared together. They have no genetic inheritance in common but they are reared in a common environment ... this correlation is .24 (p. 50)." Additionally Jensen refers to identical twins raised apart and reports that they still have correlated IQs as high as .89. A necessary assumption for his conclusion, that approximately 75% of intelligence is inherited, is that identical twins reared apart are placed in random environments.

Bronfenbrenner (1972) refutes this assumption by pointing out that identical twins, when separated, often go to relatives which cannot be assumed to be random in their environmental factors. In addition, Bronfenbrenner states: "Jensen's argument requires that any difference between two children reared in the same home be due only and entirely to differences in heredity and not at all to possible differences in treatment or experience at home, in school, in the neighborhood or elsewhere. Clearly this assumption is unwarranted (in Montague, 1975)."

Scarr-Salapatek addresses herself to the question of environmental and population effects on determining heritability. While receiving criticism from Eaves (1972) for her methodology, the questions raised cannot be easily dismissed. Responding to the claim that 75% of the total variance in IQ scores is attributable to heredity, Scarr-Salapatek suggests that a closer look at children reared under different conditions shows that the percentage of genetic variance and the mean scores
are very much a function of the rearing conditions of the population. A first look at the Black population indicates that genetics may play a more important role for members of higher socioeconomic classes than for less privileged groups.

Scarr-Salapatek's studies are particularly important in illustrating the dangers inherent in making statements about populations not directly considered in the data. While Burt's research (1966) explored studies involving over 1,000 pairs of twins, these were all Caucasians. Scarr-Salapatek (1971, p. 1285) states however:

"... the heritability of a behavioral characteristic is a function of the population in which it is measured. There is no reason to assume that behaviors measured in one population will show the same proportion of genetic and environmental variances when measured in a second population whose distributions of genetic and environmental characteristics, or both, differ in any way from those of the first population. Racial and social class groups are, for many purposes, sufficiently different populations to make a generalization from one to the other highly questionable."

Bronfenbrenner (1972) supports this position, "... presumably, identical twins are equally identical genetically whether they are Black or White and whether they grow up in advantaged or disadvantaged homes." Yet the heritability coefficient for general aptitude in Scarr-Salapatek's data was .40 for middle class whites and .25 for middle class Blacks. The contrasts for advantaged vs. disadvantaged children both Black and White, were even more pronounced.

Sanday (1972), as well as Furby (1973), supports the position that there is a relative influence of environment on intelligence test performance between groups. While an hereditarian would argue that genetic inferiority explains the differences between subcultures and populations, an equally parsimonious explanation is that deprived groups, by reason
of their cultural isolation, are unable to realize their full genetic potential.

"If most Black children have limited experience with environmental features that contribute to the development of scholastic skills, then genetic variation will not be as prominent a source of individual phenotypic variation; nor will other between-family differences, such as SES level, be as important as they are in a white population (Scarr-Salapatek, 1971, p. 1294)."

The Coleman report (1966) data supports a flexibility of genetic variance position in concluding that the scholastic environment has more influence on the performance of Black children than it does on that of white children.

Methodological Problems

Analysis of variance techniques used to interpret relative contributions of genes and environment are limited in their usefulness. A linear analysis of variance model actually measures phenotypic aspects of genes and environment and not the variables themselves, in addition there is an interaction term which must be considered. Lewontin (1974, p. 402) states: "The linear model makes it impossible to know whether the environmental deviation is small because there are no variations in the actual environment or because the particular genotype is insensitive to environmental variations, which may themselves be quite considerable."

The linear model is time and population dependent, it is not a statement about functional relations but is a reflection of the relative relationship of genes and environment for a particular population at a particular time.
The genetic variance for a character in a population may be very small because the functional relationship between gene action and the character is weak for any conceivable genotype or simply because the population is homozygous for those loci that are of strong functional significance for the trait. The analysis of variation cannot distinguish between these alternatives even though for most purposes in human genetics we wish to do so (Lewontin, 1974, p. 403).

The time dependency for this linear analysis of variance is important relevant to making predictions about gene environment interaction for other than the immediately obtained data (see Morton, 1974). This will be illustrated later in this section in reference to manipulation of traits. It will be shown that a given trait may have a high heritability (high percentage of genetic contribution) and yet be useless as a predictor due to changes in the environment.

Where high heritability exists, Thoday (1969), p. 5) suggests that we are still limited in drawing inferences across groups. He states: "... if the heritabilities are high ... we may know more than if they are low. But even if they are high as with fingerprint ridge counts, we are already in difficulties with population comparisons, for there is no warrant for equating within group heritabilities and between group heritabilities."

Weizmann (1971), in assessing the effects of different environments on analysis of variance scores, suggests that many studies have used restricted ranges of environments. Although an obtained correlation accurately describes the relationships between two variables for a given sample, if the range of the sample scores is truncated, that relationship will not generalize to more representative samples containing a wider range of variation.
Analysis of variance is not an analysis of causative relationships, this is clearly illustrated by the problem of interaction. Certain combinations of genes and environments may have disproportionately favorable or unfavorable effects upon a trait, effects quite out of line with the usual influences of these genes or environments on the trait in question. In this case we may speak of a gene-environment interaction, and can specify a part of the total variance that is due to the effect of the particular combinations over and above what might be predicted for the components separately.

While researchers generally have accepted that genes and environments are not strictly independent, in that there exists an interaction term, authors as Jensen (1967, 1969, 1971, 1973) have suggested that this interaction term contributes little to the total variation and have "lumped" it with the environmental variable.

The inappropriateness of this type of treatment for the interaction term is indicated by Lewontin (1974, p. 407), "If an event is the result of joint operation of a number of causative chains and if these causes interact in any generally accepted meaning of the work, it becomes conceptually impossible to assign quantitative values to the causes of that individual event. Only if the causes are utterly independent could we do so."

Even if we are able to make good estimations of the interaction term for any given gene-environment relation, it is not possible to make predictive statements about the effects of the interaction term for different proportions of these same variables. This again illustrates the limited nature of using analysis of variance to determine heritability.
As Lewontin (1974) sees it, the legitimate purposes to which analysis of variance could be applied would be to predict rates at which selection can alter genotypic composition of populations. However changes in this rate occur slowly relative to the rate which social and culture factors may contribute to changes in the environmental component. It may therefore be most useful to consider the extent to which changes in the environment may alter observed phenotypic traits.

**Trait Manipulation**

"Heritability is not a measure of the magnitude of the genetic contribution to a given trait (as Jensen leads us to believe), but a measure of the extent to which the variability in a trait is due to genetic factors relative to environmental factors (Sanday, 1972, p. 413)." This is illustrated by the situation in which there is a uniform environment which will necessarily have a high estimate of heritability. Correspondingly where a trait is uniform genetically, variations may be accounted for by changes in the environmental component. But, in neither case do we acquire information relative to the causative contribution of either the environment or genetics to the trait itself.

Birch (1968) argues that much of the nature-nurture controversy arises from a confusion of the concepts "genetic" and "determined." While aspects of the organism may be thought of as 100% genetic, their phenotypic expression is determined by the expression of these genes in combination with a specific environment.

Lewontin (1974) states; in commenting on the lack of utility in making heritability estimates:
The fallacy that knowledge of the heritability of some trait in a population provides an index of the efficacy of environmental or clinical intervention in altering the trait either in individuals or in the population as a whole ... A trait can have a heritability of 1.0 in a population at some time, yet could be completely altered in the future.

This is illustrated by intervention in inborn errors of metabolism. Loehlin (1975) suggests that the ability to manipulate a trait by environmental means may be greatly facilitated by understanding its genetic basis. A relevant example is the metabolic disease Phenylketonuria (PKU). If this disease is not diagnosed early in the life of the child, toxic metabolic products will accumulate in the brain resulting in irreversible damage and retardation. However, if this completely heritable (genetically caused) disease is discovered early, dietary restrictions will prevent the intake of the amino acid phenylalanine, with a resultant positive prognosis for normal intellectual development.

Based on the above cited research, it is probably appropriate to state that heritability is a weak statistical measure, and that an analysis of this type is limited to the relative percentage of genetic and environmental contribution for IQ in a given population and at a specified time. It cannot predict the effect of subsequent environmental changes on intelligence and is a relatively useless, albeit confusing, analytical technique.

Section Two

Section two is primarily concerned with the effects of nutrition on pre- and post-natal development. Studies indicate that periods of extreme deprivation have lasting effects on intellectual development (Knobloch, 1956; Dobbing, 1973, 1974).
Nutrition. Several hypotheses concerning brain development make different predictions about nutritional natal and post-natal deprivation. One is the cell division hypothesis of Winick (1966), which indicates that the crucial time for irreversible damage occurs during periods of cell division in brain development, and that undernutrition after cell division has stopped in a given tissue will not have permanent consequences if proper nutrition is restored. The growth spurt hypothesis states that the brain is most susceptible to irreversible damage when it is going through its greatest period of growth.

Loehlin (1975, p. 205), citing studies by Dobbing (1974), states: "Today there is substantial evidence, although not yet completely conclusive proof, that short periods of undernutrition in early life may permanently, irreversibly impair the structure and function of the central nervous system and thus permanently and irreversibly reduce the intellectual capacity of adults who were undernourished at a critical period early in life."

Since the molecular bases for memory and learning are as yet undiscovered, proof re: critical periods for intellectual development and their dependence upon proper nutrition may depend primarily on animal studies for the present (i.e., Balazs, 1972; Chase, 1973; Coursin, 1965; Winick, 1968). Biesheuvel (1972), reporting on studies related to maze running ability and protein deficiency in rats found that the effects of protein deprivation were significant both pre- and post-natally. In addition these deficiencies persisted for generations after normal protein had been restored.

Caution must be used in making statements about human functioning from the above studies. However, limited comparative studies in human
populations (i.e., Stein, 1970; Geber, 1956; Stoch, 1963; Cabak, 1965; Cravioto, 1967) generally support severe and prolonged malnutrition as being associated with significant and permanent intellectual retardation.

A study by Brockman (1971) indicates that sensory deficiencies directly affecting cognitive development may be attributed to severe infantile malnutrition. In that study twenty protein calorie deficient children were compared with a control group. The experimental group was found to be 6 to 8 months retarded using the Gesell Infant Scale. Although the study was concerned with primitive categorization behavior, the results showed retardation in social language, emotion and sensory integration.

Brown (1965) examined autopsy records of over 1,000 Ugandan children. Ninety-six malnourished children were compared with a control group of 104. In varying age groups between 1 and 3 years there was an average 12% difference between the brain weights of the malnourished and normal children. This finding suggests that malnutrition inhibits brain as well as body growth, but the actual relation between brain weight and intelligence requires further examination.

Brain Development. According to Loehlin (1975) the human brain weighs about 350 grams at birth, more than one-quarter of its adult weight. The brain grows rapidly, increasing nearly 200% up to the age of two years. During the next ten years there is a relatively small increase in brain weight of about 35%. The brain reaches 95% of adult weight by age 10 and usually attains its maximum by age 20.

The myelination in the brain is not well established until four years after birth. Some developmental changes continue in the brain, especially in the temporal and parietal lobes that have important roles in human symbolic and linguistic behavior, up
to the adolescent growth spurt and puberty when the brain approaches adult volume. All of these changes require synthesis of new biomolecules, especially proteins and lipids, and thus an adequate supply of essential nutrients (Loehlin, 1975, p. 211).

Additional studies which examine brain factors and malnutrition include: Fishman (1969) who examined the content of cerebral lipids in infants suffering from malnutrition; Garrow (1965, 1967) who showed that protein calorie malnutrition may be associated with loss of potassium in the brain with a resultant mental impairment; Stoch (1963, 1968) reported that, under conditions of severe malnutrition within the first two years of life, there was a significant, permanent reduction in head circumference.

Mere reduction in head size does not require a presumption of reduced intellectual ability; however, studies have shown an association between the two (i.e., Mosier, 1965; O'Connell, 1965; Pryor, 1968).

Smyth (1963) found reduced head circumference of malnourished children to be correlated with intelligence measures. Winick and Rosso (1969) have shown that reduced head circumference in marasmic children was directly proportional to reduced brain weight and protein content. Winick and Rosso suggest that the reduced head circumference has direct implication for brain growth and myelination. They conclude that children who suffer severe malnutrition may damage actual cellular growth of the brain.

While the present research suggests that malnutrition can play an important role in the subsequent development of the child in terms of both his physical and intellectual functioning, comparisons between populations must be evaluated with caution. Different nutritional factors
may play a greater or lesser role for different groups. This is illustrated by nutritional studies on Indian women.

Not all humans are identical in their qualitative nutritional requirements. It is commonly assumed that man cannot synthesize ascorbic acid; Rajalakshmi (1967, 1972) found that Indian women are able to synthesize ascorbic acid in their placenta when incubated after delivery. The races of secretion were far in excess of their dietary intake. Studies related to maternal nutritional deprivation and its subsequent effects on infant intellectual development would necessarily have to take this subgroup phenomena into consideration.

**Birth Weight.** Although some studies have explored the relationship between low birth weight and measured intelligence, particularly as twin comparisons (i.e., Bulmer, 1970; Byrns, 1936; Asher, 1949; Barclay, 1950; Scarr, 1969), Naylor (1967) in performing regression analysis of birth weight on socioeconomic variables, determined that the observed mean differences between blacks and whites is 40% environmentally determined.

Loehlin (1975, p. 330), in comparing the observed weight between groups in the same context as the observed differences for twins, says "... we would estimate that the average birth weight difference of 233 grams between blacks and whites should be accompanied by an IQ difference of about 5 IQ points. However if 60% of the weight difference is associated with racial factors that are independent of socioeconomic variables ... black-white difference of about 2 IQ points would be predictable from birth weight differences."

Studies reviewed by Caputo and Mandell (1970) showed correlations between birth weight and later measured intelligence. In general there
were no significant differences by weight on measured intelligence. However, in a study by Knobloch (1956) there were significantly more black infants with low birth weights and more neurological defects in the most studied group.

For the majority of children in the United States, the extreme deprivation which is likely to permanently impair intellectual functioning is not a threat. However, nutritional aspects are important in the intellectual development of the child. A study by Harrel (1965), suggests that adequate vitamin supplementation for pregnant mothers from deprived areas may result in an 8-point difference in their children's IQ scores.

In Harrell's study (1956) 111 welfare mothers received a daily dietary supplements of essential vitamins. A control group received an inert placebo. These pills were given during pregnancy and their children were given IQ tests at the end of 3 years. While the results were significant, 103.4 for the experimental group and 98.4 for the controls, the findings must be viewed with caution. The two groups were not controlled racially although both groups were mostly black.

Timely intervention for those who are nutritionally deprived is emphasized in all these studies. Questions about what is timely, and what constitutes significant deprivation, are still being researched and discussed.

Section Three

Section three deals with the immediate home and parental effects the child experiences in the first years of life. Studies in this area involve assessing race, educational attainment, and attitudes of parents.
Parent-Child Interaction. With respect to race differences in intelligence, independent confirmation of the decisive role of environmental factors comes from recent studies of intellectual development in children of mixed black-white marriages. From the view of genetic theory, which parent is of which race should make no difference for the child's mental capacity. The research results indicate, however that the IQ for the child correlates more with the race of the mother than that of the father. Since it is the mother who is a primary agent of child rearing, this finding is consistent with the conclusion that the suppressive environment of many people in minority groups may be a crucial factor in intellectual development.

"It appears that the explanation for the superiority of the interracial children of white mothers most likely rests on postnatal environmental influences. A good place to look for these positive influences might be in the child rearing practices of the high social classes (Willerman, 1974, p. 89)." At age four there was a significant interaction between mother's race and the IQ of the child. Children of white mothers were 9 IQ points higher than that of black mothers. However, the IQs of both parents were not compared leaving the possibility that white-female black-male couples may have a selectively higher IQs as couples than the reverse.

Kagan (1969) believes that a regressed level of intellectual development for a child may be attributable to a defective mother-child interaction. Further support for the hypothesis that the mother may be influential in the child's intellectual development is given in Golden (1971), Baley (1965), and Honzik (1957).
Baley (1965), and Honzik (1957) found that children's scores do not correlate at all with their mother's intelligence or education during the first 18 months of life, but after 18 months the correlations gradually increase, reaching a maximum of about .50 at 5 years of age.

In Golden (1971) correlations were obtained between mothers' PPVT scores and children's Cattell scores at 18, 24, and 36 months of age. The obtained correlations were .10, .28, and .32 respectively. The correlation at 3 years was between mothers' scores and the child's Stanford Binet. The Ss in this study were Black, the pattern of increasing correlations was similar to that previously reported for white families.

Further support for the influence of environment over genetics is given in a study by Eyferth (1961). Illegitimate children who were the result of mixed and non-mixed relations and all of whom had white mothers were compared on the German form of the WISC. These children were the products of relationships between German women and American servicemen stationed in Germany.

Mothers in the Eyferth study were matched on SES, in many cases locality and educational factors were controlled as well. Black fathers were positively higher than the U.S. Black population because they were soldiers who passed the qualifying exam for army entrance. There was still one standard deviation difference between the Black and white soldiers according to the induction exams. While some differences existed according to sex, the overall results indicated that there was no significant difference obtained in IQ scores.

Parental SES and Education. The study by Golden (1971, p. 39) indicates that correlations with IQ and SES also occur at about this time.
Golden suggests that this may be due to the acquisition of language. He states: "There is reason to believe that between 18 and 24 months of age there is a shift from the preverbal or sensorimotor to the verbal or symbolic level of intelligence, and that environmental conditions facilitate or retard development on these two qualitatively different levels of intelligence."

The majority of studies of children, between the ages of a few months to 4 years of age, suggest that intellectual development during this period is obtained through the acquisition of language skills. During the third year of life as children become more dependent on verbal expression they also become more susceptible to variations in the language skills and abilities of those who are in the immediate environment. Factors such as mother or father's educational level, relationship and amount of verbalization to the child may all become significant variables in the child's intellectual development.

Luria (1961) suggests that intelligence is primarily a matter of the ability to process information in abstract verbal terms. From an environmentalist position this is primarily accomplished through the child's interactions with adults. Jensen's (1969) model accounts for the differences in ability using a genetic model. In his model level II (cognitive) ability does not become prominent until the third year and it is at this time that superior genetic ability will be manifested in superior language and abstracting powers.

While Jensen's model accounts for the differences observed, a model which predicts acquisition of language skills in accordance with exposure to better language models is a simple and, if no more causally
testable, less in need of far reaching assumptions concerning heritability and levels of ability which are distinct for intelligence.

The educational background of the parents may have a significant effect on the intellectual development of the child if the environmentalist position is well founded. A study by Carroll (1970) compared IQ scores of sixth grade children of black and white educators and non-educators. The results indicate that in most instances Negro children and Caucasian children were statistically different with the white children having an advantage. This was not true, however, in comparisons between boys of Negro and Caucasian educators.

Pearson (1969) found a substantial association between parents' education and children's IQs at ages from 24-48 months. The correlation was about .40 between Midparent education and Cattell and Stanford Binet IQ scores.

Golden (1971, p. 43) differs from Pearson and Carroll in their assessment of the importance of parental education for children's intellectual development. "... the differences in the mean IQ scores at 24 months are not great enough to produce a significant F. Low significant correlations between social class factors, such as mother's intelligence and education, reflect a relatively weak effect, whereas mean IQ differences between SES groups reflect a relatively strong effect."

The relationship between SES and intellectual development is complex and, as will be illustrated by the extensive review in the next section, may be confounded with cultural variables.
Section Four

Section four includes the most extensively researched areas involving analysis of IQ measurement. It includes cultural, racial geographical, motivational, and sexual variations among groups. It is in this section that studies support an important percentage of correlation between SES and IQ.

Cultural Factors. There has been a growing awareness on the part of researchers that cultural, socioeconomic, and ethnic features of a particular subgroup in a population are not easily separable, and in many cases may be confounded. The more recent studies have taken this problem into consideration in the design of their research. Often comparisons between ethnic groups are made while their socioeconomic status is held constant or considered as a covariate. Other factors, as will be reviewed in later sections, may still need to be controlled before the groups may be considered equivalent for evaluative purposes. The numerous studies in this section illustrates the complexity inherent in making comparisons between groups.

Some studies as Wilson (1973), and Shubert (1972), have illustrated that geographical location or isolation from urban cultures can have important effects on specific attributes of intelligence. Groups which are dependent upon the ability to hunt may have an increased ability re: perceptual skills, whereas those who are involved in an urban culture, which depends on a barter system, may depend more on their verbal skills.

While Jensen (1969), has attempted to show that SES is a function of genetically determined intelligence, the great majority of
studies (i.e., Ireton, 1970; Kennett, 1972; Orn, 1972; Wienges, 1972; Adams, 1973; Freeberg, 1972), have indicated that SES is usually the best predictor of IQ performance. In the study by Wilson (1973), comparisons were made between Indian and white children using the raven and the performance part of the WISC. Significant differences were shown for educationally isolated Indian and white groups when compared to children of both groups who were receiving normal education; there were no significant differences by ethnic group alone. The author concludes that environmental factors may be more important than ethnic ones regarding test performance.

Bayley (1965, pp. 408-9), in a study of 1,409 infants between the ages of one and fifteen months, concluded that there were no significant differences between blacks and whites on comparisons between, new and later both, education of either father or mother, or geographic region. "... The one possible exception is in motor development in which the Negro babies tend to be more advanced than the whites during the first 12 months. Although there is considerable overlap of scores among whites and negroes of the same age, a genetic factor may be operating. That is, Negroes may be inherently more precocious than whites in their motor coordinations."

Variances due to environmental stimulation and cultural exposure are not confined to studies involving blacks. In a study by Shubert (1972, p. 300) four groups of Canadian school children were studied and differences in IQ were related to the amount of contact with the white urban culture. "... The major difference between the northern Indian child and the urban white child looks to lie in the fact that the former does not habitually and spontaneously analyze his experience
in verbal terms and does not formulate internalized rules that might guide him in new learning situations."

Although some Indian children in the Shubert study had the same IQ scores as mentally defective whites, there appeared to be qualitative differences between the two groups. The Indians could use other people's verbalization, and the low IQs of the two groups may result from different causes.

Inferences were made by Shubert (1972) based on his research and others that the Indian children adjust adequately to problems which occur in their hunting society but their everyday experience does not encourage verbalization. In that study, Shubert trained Indian and white Canadian children, of varying social and ethnic background, to use strategies to solve Similarity and Block Design problems from the WISC. There was a significant relationship between IQ and ethnic background. The amount of contact with white urban culture was significantly related to IQ test performance. The author suggests that the low IQ score from Ss in a remote Indian reserve shows underdevelopment in reflective verbal thought, rather than biological inadequacies.

The implication of these and similar studies is that cultural factors play a significant role in development of particular intellectual skills. Factors commonly associated with intelligence tests may not be appropriate for ascertaining intellectual potential on other than normal groups.

Race, Sex and SES Factors. Research has assessed the relationship between race, SES, and sex to IQ with varying groups and ages. Tulkin (1968) administered the Raven test to 5th and 6th graders. The effects
of race, social class and sex were different depending on which groups were studied, i.e., all social class differences were significant, while a racial difference was found only in the lower class. The author concludes that these factors must be considered when comparing groups on the Raven, and more generally suggests their necessity when assessing general intelligence and school achievement.

Gaudia (1972) administered Piagetian tasks to Indian, Negro, and Caucasian children in the first 3 grades. Age of conservation was at least a year retarded in both the Negro and lower class samples. There were significant correlations between conservation and age and IQ within all groups at every age level.

Larsen (1970) sought to determine whether norms based on a single variable would eliminate test bias. A group of Georgian children were compared with a norm group for the Stanford-Binet on race, sex, socioeconomic status, IQ level and community size. The Ss exceeded the norm group on 62% of the items. Generally more than one variable influenced item performance indicating that one criterion variable is not enough and that factors as race, SES and sex need to be considered simultaneously.

Stennett (1969) in assessing the relationship between sex, and SES to IQ change, analyzed the cumulative folders of over 800 9th graders. It was concluded that children do exhibit systematic changes in their IQ scores correlated with sex and SES. Most of these changes appear to occur in the early elementary school years.

Hertzig (1971) in comparing ethnic backgrounds and social factors for white middle-class and Puerto Rican working-class children at the ages of 3 and 6 years. Stability of IQ over time was
characteristic of both groups, however there was greater change for the white group in an upward direction.

Mercer's research (1972) analyzed the effectiveness of using scaled scores from the Vocabulary and Block design subtests of the WISC for predicting full scale IQ. Variables included sex, SES, and ethnic group. In addition relative predictive power was compared with 11 of the other subtests of the WISC. Predictive power for the subtests was found to be relative to the particular groups examined.

Holowinsky (1972) investigated race and sex differences in black and white children referred for psychological evaluation because of educational difficulties. Race differences were apparent only on the vocabulary subtest. There were significant differences between sexes on some subtests. The overall findings suggest no significant differences in intelligence between racial groups, but variations per subtest as in Mercer (1972).

Kaufman (1973) compared the WPPSI Verbal, Performance and Full Scale IQs of Blacks and whites who were matched on age, sex, geographic region, father's occupation, and urban-rural residence. In contrast to the majority of studies, whites had significantly higher Verbal and Full Scale IQs at all age levels when these factors were held constant.

In another comparison using the WPPSI, Fagan (1969) found a correlation of .80 between the Binet and WPPSI; however, there was a significant difference of 8 points between the full scale score of both. There were no significant sex, or race differences on a group which consisted of 5-year-old, lower-class children.

Rayburn (1970) studied middle- and lower-class children between the ages of 8 and 12. In addition to other tests, the similarities and
Block Design subtests were given. It was hypothesized that no significant difference would be found between black and white children on concept formation but that class differences would exist. While the hypotheses were generally supported there were significant differences across ethnic as well as SES groups. The author suggests that this was the result of an inability to match the Ss exactly on the desired variables. The black parents of both SES groups did not possess exactly equivalent jobs or education which tended to deny the children the same degree of enrichment. However, the study supports the majority of the research which shows that differences in experience, age, ethnic group membership, and sex may all be contributing factors in IQ assessment.

Studies (Davis, 1970; Glavan, 1972; Sigel, 1968) have attempted to investigate factors associated with "cultural deprivation"; these studies have been plagued by the general ambiguity of the term. The bulk of research has been primarily concerned with SES and educational level as related factors which are more readily defined. Adler (1968), in referring to the testing of the "culturally disadvantaged" cites culture, SES, language, the sample, the extent and quality of schooling motivation, physical ability, and speed as factors which influence IQ test performance. The term "culturally deprived" remains ill-defined and may contain, within its scope, many confounding variables.

A considerable amount of recent research has emphasized the importance of SES specifically in evaluating differences in IQ test performance between populations. In some studies varying levels of socioeconomic status have been used as independent variables, in others SES has been held constant in order to assess the extent to which other factors may contribute to intellectual development.
Chase (1970) compared intelligence test performance in extreme social classes. Upper and lower class children who had achieved the same score on the Otis Quick-Scoring Mental Abilities Test were matched to determine whether the items passed were different. No social-class item interaction was shown. The author concludes that children who achieve a given score on a group intelligence test are likely to do this on the same item sets whether they are from upper or lower classes.

Takacs (1971) compared mental abilities of lower SES five-year-old blacks and whites. The mean score differences on factors and tests were examined by analysis of variance to investigate race and sex differences in mental abilities. It was found that while quantitative differences in intellectual performances did sometimes obtain ... there were only negligible qualitative differences in the intellectual processes which the two racial groups brought to bear on the tasks. In contrast, while quantitative performance levels for the sexes were similar, there appeared rather large differences in the relationships between abilities used in processing various tasks.

Chase (1971), in a follow up of a prior study (1970), evaluated item-social class interaction between middle and lower SES groups. Varying criteria establishing SES were used including fathers' occupations following guidelines from the Warner scale, and occupational categories of the dictionary of occupational titles. In neither case were there item-social class interactions and differences were observed to be in overall IQ not skills for processing.

Citing a study by Cleary (1968), Chase indicates that, while no item social class interaction was found, there appears to exist conspicuous differences in language ability across races but not social
classes. Item-social class interaction may therefore be confounded if the samples included both black and white children.

In a study by Burns (1970) comparisons were made between black and white boys from lower and upper middle class homes. As expected, Ss in both lower classes did the poorest. However, the configuration for both groups were similar. Where differences in patterns on the WISC occurred these were between SES groups not between races. The author suggests alternative implications, i.e., the sample was not representative, or new norms need to be established.

While Jensen's model attempts to account for IQ variation through genotypic differences, a study by Ireton (1970) demonstrates that SES is still the best predictor of intelligence in an all white urban population. In a longitudinal study conducted in Minnesota on 536 children, Ireton (1970) comes to the following conclusions:

Comparing the relationships of infant mental score and SES with 4-year IQ suggests the following: (a) both correlate with 4-year IQ, but SES shows a higher correlation, (b) the SES variable operates throughout its range; the mental score IQ relation derives primarily from the relationship between low mental score and below-average later intelligence, (c) the low mental score-low IQ relationship cannot be explained in terms of SES in that SES did not correlate with infant mental score, (d) low mental score tends to be a better predictor of below average intelligence than low SES ..., (e) high mental score or high SES is associated with a very minimal incidence of below average IQ.

Newcomer (1972) compared differences in word errors on the PPVT using two differing SES groups. One school was small, rural and qualified for compensatory education funds; the other was in a unified district. The results indicated that there is a significant difference between mean error scores on Verbals as a function of sex, intelligence, size of family, and birth order. There was a significant
difference on Labels for Objects as a function of SES, attendance at a compensatory school, grade, ethnic group, bilingualism, and IQ. The implications from this study include the fact that the nature of the particular test; as well as sexual, racial, and environmental variables, is correlated with the resultant performance. The author suggests that the educational needs of each child should be predicted on the basis of particular characteristics and not solely by group membership.

In a study by Mayeske (1972), in reanalyzing the Coleman report, variances for ethnic group and SES were considered. For sixth grade students SES correlated .50 with achievement, racial ethnic differences correlated .49 with achievement, and SES and racial ethnic differences correlated .37 with each other. This means that 12% of the variance is attributable to SES independent of ethnic group; 11% attributable to ethnic group independent of SES, and 13% to the two combined. The total predicted variance is 36%. It is apparent that nearly two-thirds of the total variance lies within groups. Children within any given ethnic group or SES level differ tremendously in level of academic performance.

From Mayeske (1971), the social conditions which were important were: social and economic well being of the family, the presence or absence of key family members, the student's and parents' aspirations for schooling, their beliefs about how the student might benefit from an education, the activities that they engaged in to support those aspirations, the region of residence, and the achievement and motivational levels of the students one goes to school with.

Studies have considered whether there are different levels of specific intellectual abilities across ethnic groups. Brunson (1968) compared groups of differing SES on IQ and scholastic achievement
measures. One group was from a culturally disadvantaged area while the other was from a middle-socioeconomic class area of Omaha, Nebraska. From each of two groups of 150 students, 50 were chosen at random and administered the WISC. There was a significant difference between the means for each subtest of the WISC except for picture arrangement. Examination of varying grade levels revealed that children in the disadvantaged area started their elementary careers in the average range and then fell slightly behind. The middle class children however improved their relative position as their careers progressed. The author suggests that the attributes emphasized in the picture arrangement subtest might more accurately measure true intellectual potential since this factor was not subject to variation due to SES.

Guinagh (1969) conducted a study to examine whether differences exist in basic learning ability and intelligence as a function of SES. Basic learning ability was measured by a Digit Span test and Intelligence was measured by Raven's Progressive Matrices (RPM). Three different populations of third grade children served as Ss: Low SES black children, low SES white children, and middle SES white children. Correlations between the DST and the RPM were .10 for low SES white, .22 for low SES black, .34 for middle SES white. An experimental treatment was given to selected high and low scoring Ss. Twenty children were selected who scored low on both the RPM and DST and twenty who scored high on the DST and low on the RPM.

The experimental treatment had different effects on the high and low digit span experimental groups for the two races. In the low SES white sample, both the high and low digit span groups had scores on the RPM posttest significantly greater than their respective control group. In the low SES black group, only the high digit span experimental group had RPM posttest scores larger than its control group.
Combining high- and low-SESs with average- and low-IQ levels, Orn (1972) acquired 4 groups of 7- to 11-year-olds. Each S was given a short-term memory and coding task. The average-IQ Ss in the high-SES had better short-term memory than the low-SESs. The reverse effect was found in the low-IQ Ss. The author suggests that this supports a primary and secondary retardation classification model as proposed by A. Jensen (1969, 1971, 1973).

Hatch (1970) examined possible differences between low and middle SES sixth graders. SES was determined by the Index of Status Characteristics developed by Warner. Tests were designed to measure self-concept, academic achievement, and intelligence. The WISC was used to establish an overall IQ score and the subtests as well as full scales were compared to test for significance. Contrary to the majority of existing research, except for the similarities subtest, there were no significant differences. The author suggests that a replication of the study may be necessary to determine whether the sample is unique or homogeneity for intelligence was inadvertently obtained due to some factor in selection.

Willis (1970) used a concept identification (CI) task, the Bender-Visual Motor Gestalt Test, and the Vane Kindergarten Test (VKT) to determine which of these variables would differentiate children from the pre-, first-, and second-grades who were grouped according to lower and middle SES. The results indicate that, for this sample, lower class Ss perform comparably with middle class Ss on a CI task. However the LC Ss are clearly less efficient on visual motor tasks. The VKT was effective in differentiating children by social class and age groups
through the first grade. In addition there was a low correlation between CI and perceptual tasks.

Hemberger (1969, p. 3321) evaluated the performance of middle and lower SES children from pre-school through grade five. The test battery included the WISC, the PPVT, the FRPVT. The WISC was divided into parts for each subtest which resulted in 26 variables. The data were factor analyzed and rotated. The results indicated that middle class Ss consistently exceed the lower class Ss in the total number of factors identified. "Four factors were continuous in that they appeared at the pre-school level and persisted through the fifth grade for both samples. These factors were: Verbal Comprehension, Perceptual Organization, Numerical Ability, and Perception of Incongruity. Two additional factors, Conceptual Foresight and Verbal Concept Formation, were continuous for the middle socioeconomic status subjects only."

Using the Bender-Gestalt Test, Moseley (1969) tested the visual maturation of deprived and non-deprived children between 8 and 10 years 11 months of age. Significant differences were found between the respective groups. All deprived children were then divided into white and Negro subgroups. Analysis of the data indicated that while both groups were regressed relative to the existing norms, the white children were about one year retarded in their visual motor development while the Negro children were about four years behind the normative group of the Koppitz study.

Other studies as Albott (1971) and Snyder (1971) have specifically explored the kinds of errors that Negro children make relative to the norms used by Koppitz. Both of these studies report significant differences between black and white groups for certain shapes and angles,
integration of different parts of a figure, and two errors involving rotation. The two rotation errors were the only ones which occurred more frequently among black third-graders than white first-graders. Rotation errors, according to Koppitz, are frequently associated with reading difficulties.

Tate (1967) used the Henmon-Nelson Test of Mental Ability, the ACT test, and Hollingshead's Two-Factor index of Social Position (education and occupation) to compare Negro and white groups of similar SES status. Results at the first two Social Status levels indicated no significant differences between the black and white groups. When intelligence and social status index were controlled in the covariance analysis, the five ACT achievement variables yielded F ratios significantly higher than the white sample. The author concludes that, on the basis of this research, Negroes in Social-Status Index I and II achieve as well as their white counterparts.

Datta (1967) assessed the effects of ethnic group and sex on the IQ equivalent scores and the congruent validities of 956 children taking the figure drawing test. No significant effects were reported. Both PPVT and Draw-A-Person mean IQ equivalents indicated substantially lower performance for head start than for normative groups.

Yen (1969) tested 100 children 4 years old from three ethnic groups (Caucasian, Negro, Lumbee Indians). They were given the Stanford-Binet, Draw-A-Man, and the PPVT. The purpose of the study was to determine variability between these test measures when the Ss came from the same environment. The overall mean on the Stanford-Binet using all the Ss was comparable to the standardization norms. The DAM and PPVT were below the national norms. The mean M.A. and IQ scores of the
three tests were not significantly different from each other in the three ethnic groups. The correlation of the mean M.A. and IQ scores varied divergently. It is suggested by the author that interpretation of the DAM and PPVT results should be used with caution.

Lamp (1973) compared Slosson Intelligence Test scores and later academic achievement of 152 black girls and boys who attended a school in an economically depressed urban community. Significant but low correlations (.29-.43) were found between the SIT, CAT, and teacher assigned grades. This research suggests that IQ tests are of limited value as a predictor of later academic achievement.

Croake (1973) administered the WPPSI and other tests to sixty-three 3- to 5-year-old lower SES black boys and girls. Mean IQs were consistently higher for girls, posttests, and the performance scale, and decreased with age.

In a longitudinal study by Golden (1971, p. 37) 89 black children from varying SES groups were assessed on the Cattell Infant Intelligence scale at 18 and 24 months of age. There was a highly significant mean IQ difference on the Stanford-Binet at 3 years of age between children of welfare and middle class black families. "The range in mean IQs of the black children in the extreme SES groups (93-116) was almost identical to that obtained by Terman and Merrill in their standardization sample of 831 white children between 2½ and 5 years of age."

In a study by Rapier (1968) the learning abilities of 80 normal and retarded elementary school children from high and low SES backgrounds were compared. Results showed IQ differences in performance in both SES groups on serial and paired associated learning. Over three separate trials an increasing superiority of performance was evident for the low
SES retardates as compared to the high SES retardates. This study suggests that lower SES retardates may benefit more than high SES retardates in the area of personal instruction and additional training.

Kennet (1972), in studying a rather homogeneous sample of upper and middle class children from the same school area, found comparable results to prior studies. There was a significant correlation between SES and IQ scores. In this case significant differences occurred between upper and middle class children indicating a continuum from lower all the way to upper classes re: IQ scores.

Lesser (1965), compared lower and middle class 6- and 7-year-old Chinese, Jewish, Black and Puerto Rican children on verbal ability, reasoning, number facility and space conceptualization. They concluded that ethnology is a highly significant factor acting upon the levels, as well as the pattern of mental abilities. Social class is a significant factor influencing the level of mental ability, but it is not influential on patterns of mental ability.

Feldman (1973, pp. 17-18), in commenting on Lesser's studies, makes the following criticisms: "... the principal problem with his group patterns is that rankings on sets of tests may lead to different patterns as a function of data transformations. Raw score patterns may lead to different inferences concerning the intellectual strengths and weakness of a given group than normalized scale score patterns. In the absence of normative or predictive data, no basis for determining the 'real' pattern currently exists."

Backman (1972) studied patterning of intelligence according to six criteria and across different ethnic backgrounds including Jewish-white, non-Jewish-white, blacks and orientals. Significant variance in
patterns of mental abilities was shown for all groups, in addition variances occurred between sexes and significant but small differences occurred between different SESs.

In a 1973 Jensen study second and fourth grade Black and white children were tested on categorized and uncategorized lists. The results supported earlier studies by showing no significant differences between Ss in either grade on the uncategorized list; no differences at the second grade on the categorized list; a significant difference in favor of the white Ss on the categorized list at grade four. However, as with prior studies, racial ethnic identification and SES differences were confounded in this and previous studies so that differences in level II abilities may not be readily ascribed to either racial or SES differences.

It is clear that a distinction should be made between an ability to perform in an abstract mode or method and a preference for performing in a certain style on a categorized recall test. It has clear implications not only for estimates about genetic differences between groups, but educability of what Jensen refers to as level two abilities as well.

Orn (1971) compared high and low SES groups having average and low IQ scores on short-term memory tasks which are believed to relate to level I ability as described by Jensen (1969). The results indicated a crossover effect in that, in terms of cognitive functioning, the low SES retardates were superior to high SES in level one tasks. This study generally supported Jensen's views concerning primary and secondary retardation. It was observed that for the average IQ level the high SES sample did better than the low SES sample in short-term
memory (a level I ability), the reverse was true for the low IQ level.

Stephenson (1972) analyzed level of ability and pattern of psycho-linguistic performance using 160 black and white first graders. The Ss were grouped according to four SES levels by the McGuire-White Index. Results indicate that the performance of the Black children on both criteria was relatively free of influence by SES, but the performance of white Ss was significantly related to SES. The lower SES levels and the Black Ss showed more variability than the middle SES and white Ss. The study did not support prior research which indicated lower SES visual motor orientation and middle SES auditory vocal preference.

Circirelli (1972) factor analyzed the scores of over 1300 first, second and third graders on the ITPA, and standard achievement tests. Two main factors were identified: achievement and language. For the ITPA subtests two had moderate loadings on achievement. Auditory association and grammatic closure were relevant to achievement for the total sample; for the black and white subgroups auditory reception and auditory sequential memory also loaded on achievement suggestion there is a relation between auditory perception and subsequent achievement although this may be correlational and not causative.

Meeker (1973) using Guilford's Structure of Intellect (SOI) model analyzed the Stanford-Binet responses of Mexican, American and Negro boys from lower SES backgrounds. Three dimensions of abilities were considered: operations, content, and processes. There were significant interaction effects between culture of the Ss and SOI abilities. The author suggests that SOI ability assessments should be used instead of conventional IQ scores.
Bruch (1971) supported Meeker's research in interpreting Stanford-Binet results in such a way as to identify gifted black pupils who come from disadvantaged situations. Among the factors which are related to the disadvantaged gifted are: visual and auditory figural content; memory operations; practical problem solving; units products; systems products. The author recommends that these factors be considered when attempts are made to determine gifted individuals from disadvantaged circumstances.

Telegdy (1973) evaluated performance patterns on lower and middle class learning disabled boys by using the WISC. No SES-IQ interaction was apparent. The analysis indicated that the Ss, regardless of SES, scored lower than normals on the information, comprehension, arithmetic, and coding subtests of the WISC. Additionally no significant differences were obtained between lower and middle class Ss on verbal abilities. It is apparent that implications from this study are limited to the population sampled.

Leifer (1972) sought to determine whether differences exist in cognitive abilities among disadvantaged four-year-olds from different cultural backgrounds. Twenty Chinese, Puerto Rican, Negro, and Italian boys and girls were given four tests which measure specific cognitive abilities including: constructional, understanding of body parts, the ability to copy geometric forms, and verbal ideational fluency. A comparison of the means of the four ethnic groups showed significant differences between three of the four abilities measured. Chinese children did significantly better than the other groups in construction ability and in understanding of body parts. Italian, Negro and Puerto Rican children significantly exceeded Chinese children in verbal...
ideational fluency. No differences were found among the groups in ability to copy geometric forms. There was no apparent sex by culture group interaction.

Factor structure of the WISC was analyzed for three ethnic groups by Silverstein (1973). In that study over 1300 Ss of American white, Negro, and Mexican origin were compared in terms of their verbal comprehension and perceptual organization. The results of the two methods of assessing factorial invariance suggest that the WISC did not measure different abilities in any of the groups.

Rayburn (1970) tested black and white middle and lower class children on similarities and block design; in addition to other tests. It was hypothesized that black and white children would not differ significantly in concept formation. It was also hypothesized that middle class children would have a significantly higher level of conceptual ability than would those from the lower class and that older ones would perform better than younger ones on the tasks. In general, these hypotheses were supported.

Burnes (1970) sought to establish whether there were significant differences in patterns of WISC scores for children from different ethnic and class backgrounds. Negro and white boys from lower and upper-middle-class homes were given the WISC. Statistical analysis revealed that lower class Ss of both races obtained lower scores than their ethnic group counterparts in the upper-middle classes. In general, configurations of scores are similar. A few differences were found between SES groups but not between races. This study supports the position that children who do well on IQ tests get similar answers correct and there is no ethnic pattern for similar scores.
Harris (1972), using a representative sample of children between the ages of 6-11, compared ethnic, SES, and regional differences. Regional differences were not found except for the South where both blacks and whites were below the nationwide norms. There was a consistent relationship between father's education and family income and test scores. The author suggests that the generally regressed level of income and education for the Negro Ss may play a significant role in the observed differences between blacks and whites on the Goodenough-Harris Drawing Test when used as a measure of intellectual ability.

Entwisle (1972) grouped several hundred ninth graders according to sex, race, and residence (urban or rural), and IQ (high, medium, and low). Ss were given the Intellectual Achievement Responsibility Questionnaire and a test anxiety questionnaire. Analysis, according to the author, suggests that neither factors associated with anxiety or locus of control bear consistent relations to social class. Findings also support the conclusions that region of residence and social class must be accounted for either experimentally or statistically when assessing IQ.

Stephenson (1972) compared scores on the ITPA for black and white children from four SES levels. The results suggest that the level of performance and pattern of linguistic abilities of Negro children is relatively free of a systematic influence from SES but the performance of white children is related to socioeconomic status.

**Motivation.** Another factor considered relevant to IQ test performance is that of motivation. Wienges (1971) studied the relationship between SES and lower and middle class black and white children under
three reinforcement conditions. SES was shown to be significantly related to effects of reinforcement but not race. Additionally, material reinforcement was more important for black lower class than white middle class, and verbal reinforcement had greater effect for blacks than whites. Blacks and lower class students would appear to have significant gains in IQ scores using various reinforcing techniques.

Variations in the influence of particular motivators may be related to differences in nonintellective factors which go into producing a given IQ score. Cass (1968) compared WISC scores for upper-middle and lower class blacks and whites. Nonintellective factors included attention, energy, social skill, task persistence and concern about performance. The author concludes that most differences are related to SES, not race. In addition, directions of differences in performance were as expected, however there were similarities among the configurations of scores for the groups of subjects. The ratings of lower class blacks showed abnormal energy level, very deficient social skill and deviant concern about performance. The use of direct material incentives may be necessary to offset inadequate attending behavior.

A study which sought to determine whether children from different SESs are equally motivated to do well on a standard intelligence test was done by Fast (1967). In that study 60 white male fifth and sixth graders were divided into upper middle and lower SES groups by Warner's Index of Status Characteristics. All Ss were given two administrations of the WISC with a three-month interval between sessions. The first session included the standard WISC format for administration; the second
provided either verbal rewards or a monetary incentive. The results showed no significant differences between the standard and rewarded administrations. The implications are necessarily limited to this particular population and these incentives but the author concludes that the general test situation provides an adequate motivator for these groups.

Graham (1970) analyzed the effects of material and social incentives on middle class and lower class preschool children using the WPPSI. It was hypothesized that in the neutral condition, middle class children would perform better; in the material incentive situation lower class children would do better; in the verbal reward condition middle class children would improve the most. Only the first hypothesis was supported. The author speculates that the material incentives may have served as distractors for the particular population studied.

Galdieri (1972) investigated the relationship between verbal and neutral modes of test administration of the WISC. Ss were 72 middle and lower class rural third-grade children. Factor analysis revealed no significant differences between the middle and lower SES groups relative to their degree of responsiveness to both types of situations.

Devlin (1971) attempted to determine the reinforcing effect of knowledge of results (KCR). The Ss were 120 fourth-graders who were grouped according to SES and IQ. Two IQ levels were used and two SES levels giving a total of four groups. The subjects were measured on a concept of equivalence task. Two performance scores were obtained on each subject, one a measure of concept formation the other a measure of accuracy. Analysis of variance and orthogonal contrasts were used to analyze the data. No significant results were obtained. The author
cites the possibility that performance on the task may have been an inappropriate dependent variable to use when trying to demonstrate motivational effects.

Conflicting theories were examined in a study by Higgins (1968). The research was initiated to try and account for the poor test performance of lower SES children. The two theories included the early damage theory and the alienation theory. Upper and lower class SESs were assigned to extrinsic and conventional reward conditions. Multivariate analysis indicated significant improvement in the test performance of lower SES children when extrinsic rewards are offered.

The general consensus of authors in this area of research is that lower class and black children are more responsive to material incentives than are middle class and white children. The implications for education are apparent especially concerning grades in that, as symbolic representations of achievement, they may not possess the immediacy or tangibleness that is reinforcing for the lower class or black child.

Section Five

Section five deals with differences in abilities associated with varying factors in the school situation. The Coleman Report (1966) attempted to assess factors which accounted for the observed differences in performance between the white and black child. One of the most significant inferences drawn from that study was that lower-class and black children appear to be more sensitive, in terms of their ultimate performance, to school factors than white or middle-class children. Some of these factors include: Teacher race, teacher.
attitude, class size, racial and SES mix of children in the class, facilities, and amount of money spent.

School Related Variables. Significant changes resulted from the Coleman study, not the least of which was support for busing in order to improve racial balance. There are however several methodological problems in the study, one of which involves children's reports of parental attitudes. A self-report inventory asked questions related to the parents' attitudes and interest in their child's schooling. Although the children showed no significant differences in their self-reports, observations and records of parent behavior indicated significant differences between black and white groups and lower- and middle-class groups. Apparently a lie scale such as is used in the MMPI would have been helpful in this part of the evaluation.

Gay (1973, p. 338) suggests that there are distinct cultural differences between parental and peer support sought by black and white groups. "The black child in performing looks for verbal and kinesthetic support from his peers. The teacher hears noise and is threatened. The child's success is measured by his peers by the extent to which he stimulates others to provide responses. When this behavior is manifested, teachers see an undisciplined and discourteous group of blacks."

Additional support for the hypothesis that black children are more peer-approval oriented is given in a study by Katz (1964). That study showed that performance of black subjects on a digit symbol matching task of the type commonly used in intelligence tests varied as a function of the comparison group the subjects thought would be employed. From this study it appears that the black person's performance on a test of this type may depend upon which groups he believes that he will be
compared. This may be related to not only motivational aspects, but levels of anxiety which have been demonstrated to show a curvilinear relationship with test performance.

Studies as Schmideberg (1969), suggest that the initial low IQ score given to a child early in his schooling may result in a mental set for his teachers and a self-fulfilling prophecy for the child. Their achievement may be disbelieved or minimized and subsequent intellectual evaluations will be confounded with poor expectations and lack of motivation.

Research by Barnes (1973) supports Schmideberg's observations. In his study, in which errors in IQ test items, test norms, language use, and examining procedures were studied to determine their effect on the placement of minority children, teachers' mental states were observed to be important in terms of the child's learning and performance. In addition, IQ scores were seen as providing a source for mental sets and expectancies by the teachers which are communicated, in nonverbal ways, to the students.

Guthrie (1971) used a factorial design which included 4 instructional treatments, 2 SES levels, and 2 levels of IQ. The study was conducted to determine the best method for teaching a concept formation task to 64 black fifth and sixth grade students. Results indicated that the same instructional procedures were most effective for both SES levels, and that the high SES group learned in significantly fewer trials than the low SES group.

Some researchers are not content to observe differences between populations relative to their intellectual functioning. The practical implications may be more important than an academic discussion about the
relative merits of genetic or environmental theories. Luria in commenting on this problem refers to an analysis by Bowles and Gintis who observed that the IQ score, no matter how predictive of success in school, turns out to be less than relevant to economic success. The son of an industrialist with an IQ of 90 has an enormously better chance to succeed than a black youth with one of 120. Luria (1974, p. 28) goes on to state: "There is even a more cogent argument. Even if IQ were inheritable and its differences between races statistically significant, there is nothing sensible one can do about it except possibly abolish IQ tests ... or improve school curricula...."

Many of the studies in this section address themselves to learning potentials and enrichment programs which may alter the presently observed differences between groups. In addition variables relevant to the classroom situation, as the effects of teacher attitudes or peer influences, are considered.

Felton (1973) examined the possible effects on IQ scores for a group of black low achievers. The experimental group consisted of college students enrolled in a special rehabilitation program. The Ss in the experimental group received a 14-week program including instruction in reading techniques, writing processes, study skills, and problem solving procedures in addition to daily group psychotherapy. The California Test of Mental Maturity was administered as a pre- and posttest. The mean score for the group prior to the experiment was 100. After the 14-week program the mean IQ score was 116. There was no significant change for the control group which did not participate in the program.

Anderson (1972) assessed the importance of self-directed activity in the learning process and its relation to reading achievement, IQ, race,
and family mobility. Positive correlations were found between self-directed activity and IQ and race. Teacher estimates of self-directed activity were lower for males than for females, although no significant differences were found in achievement scores. Lower SDA groups tended to be composed of a significantly greater number of black Ss. The author states that the results support the use of self-directed activity in reading instruction and related areas.

Hausman (1973) analyzed the efficacy of three learning potential assessment procedures with Mexican-American educable mentally retarded children. Various IQ tests were used including the Spanish and English versions of the WISC. While other tests including the Raven, Picture Motivation Scale, and PMA were significant predictors of achievement, the WISC tests were not. The author concludes that a multifaceted assessment model is necessary when evaluating children of this type.

Archer (1970) evaluated the effects of a preschool readiness program which included an eight-week summer session. Four groups of Negro and two groups of white children were selected from public schools for participation in the program. All of the students were eligible to begin first grade at the start of the school year. All the Ss were administered two forms of the PPVT as pre- and posttests. Significant differences occurred in the Raw Score and Mental Age at the .05 level. The eight-week program had a significant, positive effect on the white students, the male students, and those in a certain age range.

Bowles (1968) assessed the changes in WISC IQ scores for a group of Negro and white children who were enrolled in two special education schools. Pre- and posttests were administered over a twenty-month interval. Factors in the analysis included, age, race, sex, family
income, number of siblings, ordinal position in the family, residence and employment status of the male parent. Significant correlations were found in the areas of race, age, and income related scale score changes. Primarily it was shown that Negroes gained most from the program; younger Ss showed greater gains as did those students from lower SES. The author concludes that the IQ tests given are not reliable instruments for Negro and economically deprived children.

Marshall (1971) addressed himself to the problem of increasing IQ through enrichment. In order to test the effectiveness of a 9-month innovative enrichment program, 14 disadvantaged black 4-year-olds were tested on the Peabody Picture Vocabulary test. After the ninth month period mean scores on the PPVT increased significantly by a mean of 23.5 points. This study should be regarded with some caveat. No reference was made to a control group and it would be impossible to determine the extent to which the program itself contributed to the significant gain in IQ scores. Other factors as the children's natural development and the attention paid to them as a result of the study may have contributed in unknown degrees to their increased level of performance.

Dusewicz (1971) also describes an experimental academic preschool enrichment program which was made available to a group of disadvantaged black children. The results of that study indicated significant gains on the Slosson Intelligence Test and the Peabody Picture Vocabulary test but not on the Vineland Social Maturity Scale.

Scott (1974) reports on a follow-up assessment of a family-centered preschool enrichment program. Using the Primary Mental Abilities Test, black and white Ss who were involved in the program, were retested. The profiles of the white Ss' remained stable but the black Ss had accretional
shifts on the number-facility and spatial-relations subtests of the Primary Mental Abilities test.

Collins (1969) studied achievement, intelligence, personality and various school related variables of children from intact and broken families attending parochial schools in Harlem. On the intelligence factors the following observations were noted: A family difference significant at the .05 level was found for the fourth grade only; the group from intact homes received the highest scores; there were no significant differences according to sex; IQ scores tended to increase at the upper grade levels.

Peer Comparisons. In comparing WPPSI IQ scores of matched groups of black and white children, Kaufman (1972) considered 5 variables including father's occupation. The standardization sample included 132 matched pairs of preschool children. The results showed that whites have higher verbal and full scale IQs at all age levels, but the difference was 33% smaller than is commonly observed between black and white comparison groups. Performance scores for the groups were not significantly different and any disparity decreased with age.

Kresheck (1973) also compared a group of preschool children. Fifty white and 50 black children were given the PPVT. White children scored significantly higher. On the average black children were behind about 1 year and 10 months. The author concludes that the PPVT appears to be unsuitable for testing black children's receptive vocabulary.

In an extensive study McClary (1969) matched black and white children on race, sex, age, intelligence, and family income of the school community. Ss consisted of 176 first graders, and 176 fifth graders.
The PPVT was modified so that the pictures contained humans with negroid as opposed to white features. The major findings include:
Both first and fifth grade Negro and white children had a higher dislike for the pictures of Negroes; all first graders and fifth grade Negro females administered the modified PPVT showed no significant differences in preferences for Negro or white pictures; only one significant correlation out of 32 was found between errors on human content on the PPVT and expressions of dislike for Negro or white pictures. Affective reactions to the pictures used, therefore, seem to have limited relationship to performance. The author concludes that, while there is little identification with Negroes in either group, attitudes in this area do not effect test performance.

Oakland (1971) analyzed data from two studies which included comparison of scores on the WPPSI, WISC, and Stanford-Binet. Ss were 29 Negro head start pupils and 24 white kindergartners. The Negro children scored lower on the WISC, however the Negro Ss did better on the WISC and the Stanford-Binet. Stanford-Binet appeared to more closely correlate with WISC and WPPSI verbal scales rather than the performance ones.

Goldstein (1971) compared WISC and Drawing Test scores of Negro and white children attending a child guidance clinic. White males scored significantly better than black males on the verbal part of the WISC. White females, however, scored significantly higher on the verbal, performance, and full scales of the WISC in comparison with Negro females. The author explains these differences in terms of variations in presenting symptomatology which suggests that the subgroups were not equivalent.
Muzekari (1967) administered the Draw-A-Man test and the Stanford-Binet to 64 white and 41 Negro children. There were significant correlations between the tests in both groups. However, when revised norms were used for the Negro group on the Draw-A-Man test, a lower correlation with the Stanford-Binet was obtained. The author uses these results to question the efficacy of using the Stanford-Binet with black populations.

Peck (1972) compared the performances of 105 white and 105 Indian Subjects on the WISC. Analysis included t-test comparisons of the subtests and evaluations of possible sex differences. In addition, the sex of the examiner was considered as a possible variable. The total white group was higher on full scale scores as well as all the subtests. Although the results did not reach the .01 level of confidence, female examiners produced higher scores in 8 out of 10 subtests for the Indian population. On individual subtests there appeared to be some group as well as sex differences.

Christiansen (1970) used several measures of the WISC including Full Scale, Verbal Scale, Performance Scale, verbal comprehension, perceptual organization, freedom from distractibility, and relevance. The Ss were 92 Anglo- and Spanish-American children of lower and middle class SES who were between 13-14 years old. SES was a significant variable on all factors while ethnic origin was for Full Scale, verbal comprehension Verbal Scale and relevance.

By using the Columbia Mental Maturity Scale, Sternlof (1968) evaluated the intellectual functioning of 34 "deprived" Negro and 54 "similarly deprived" white children. Both groups showed significantly lower test performance than the norms. Both the Negro and white groups scored below their chronological age on the Draw-A-Man test. There were
no observed group differences on the Vineland Social Maturity Scale. These variations among tests are used as a basis for the author to conclude that caution must be used in testing this type of population with conventional IQ tests.

Bonner (1970) used a group of 60 black senior high school students, who were apparently functioning adequately in their school setting, to analyze the inter-test reliability of the WAIS and PPVT. Although the scores were somewhat lower on the PPVT, there was a positive significant correlation between it and the WAIS. For this particular population the PPVT may serve as a gross approximator of intellectual functioning if the WAIS is not used, according to Bonners' conclusions.

Sattler (1973) tested 80 normal and 20 cerebral palsied preschool children to determine whether a modified, multiple choice forms of the Stanford-Binet, and the PPVT were reliable instruments for both of these groups. The form L-M of the Stanford-Binet was used for a criterion. IQs derived from the three tests were not significantly different for both groups. SES was related significantly to SB scores but not to PPVT scores for the normal group. The author suggests that the modified SB and the PPVT are both reliable for these groups.

Assessment for Deviant Groups. The previous section was concerned with comparisons of subgroups from primarily normal populations. This one is concerned with the utility of various intellectual tests in assessing deviant groups. For example Henning (1967) administered the WAIS or the WISC to over 2000 white and Negro male delinquents. Various test and race differences were noted particularly in relation to differences in verbal and performance scales. Higher performance abilities applied for all groups except Negroes who were given the WAIS. Reading
patterns were analyzed and the relation between these and scale scores on the IQ tests were ruled out.

A similar study on delinquents was conducted by Murray (1973) in evaluating over 2000 boys from Anglo, Black, and Chicano ethnic groups. Mean IQ scores between the groups had a 15-point range with whites the highest and blacks the lowest. WISC scores were lower than WAIS scores for all groups with this factor exaggerated for blacks. Performance scales were higher for all the groups. The Chicanos did poorly on the verbal subscales but scored near the normal range on performance.

Diener (1974) compared the WAIS and the Quick Test for a group of black, male, adolescent underachievers. At the lower ranges of intelligence the Quick Test underestimated ability as compared with the WAIS. It is recommended that a regression equation based on local norms be used when assessing Ss of this type if the Quick Test is to be used.

Smith (1969) evaluated scores of 199 Southern Negro and white children whose IQ scores fell below 69 full scale on the WISC. Examination of the function weights and test mean differences revealed that the pattern of intellectual performance was typical for retardates when comparing a standardization group to the white Ss. However, the scores for the Negro children were more consistent with a pattern found in gifted children in that their verbal test scores were generally higher than their performance scores although both were significantly regressed.

Costello (1970) tested 17 negro children who were in an urban Headstart program. The Leiter International Performance Scale was evaluated along with the Stanford-Binet. According to the researcher there were no sex differences and, in comparing the tests, there was a greater variation for the Leiter scores implying its lack of utility relative to the Stanford-Binet for this particular population
Leifer (1972) using the Lowenfield Mosaic Test compared a group of deprived black and white preschoolers. The Ss included 43 blacks and 46 whites. All of the Ss appeared to be regressed about 1½ years behind their expected test ability. The author indicates that environmental conditions have the same potential for producing unfavorable consequences in either race and that race and SES are often confounded in studies which attempt to determine ethnic differences in intelligence.

O'Grady (1974) assessed psycholinguistic abilities of 90 children from three educational settings. The settings included: learning disabled, emotionally disturbed, and normal. The first two groups were lower in ITPA abilities than the normals, but were not significantly different from each other. Total abilities were related to intelligence as determined by the SB or the WISC, but not to SES. Children from higher SESs did better on auditory-vocal subtests. Disadvantaged children showed equal or superior performance on visual motor subtests. The implication of this study, as seen by the author, is that instruction should be individualized according to the specific needs of the child whether he is in the disabled, disturbed, or normal setting.

Section Six

Section six deals with a frequently researched area in which the IQ tests themselves have come under criticism in relation to their validity and reliability. The Binet, Wechsler, and many other IQ tests have subscales concerned with social values. The correct answer in these cases is not the one with which most blacks, either poor or middle class, would agree. The questions are designed to detect whether the subject is aware of common social values. Unfortunately the final scores
do not reflect the extent to which these are products of ignorance or differences in experience and values. Wechsler has recognized this difficulty and has suggested that the examiner in the test situation determine if the response is culture specific and give credit accordingly. This does not appear to represent a viable solution since the interpretations of what is culture specific may vary significantly across examiners.

**Test Variables.** There is an apparent conflict between the need to have predictive validity, and the desire to have a test which is culturally nonbiased. IQ tests are often used to assess learning potential and ability to achieve academically; in this situation a test which is culturally fair, but says nothing about future performance, will be meaningless.

According to Darlington (1971), the very use of the term "culture-fairness" implies a concern for the proportions of people from different cultures selected, and in particular, a feeling that positive benefits flow from selecting members of "low-c" cultures. This is accomplished by lowering $r_{cx}$ (correlation between the test and culture). The core of the problem lies in the fact that a low $r_{cx}$ may be considered a socially desirable goal, but this goal may conflict with the desire to maximize validity ($r_{xy}$). The proper relation between these two correlations is determined by the relative weights given to the two goals and these weights will generally be determined by nontechnical social and political considerations.

A not usually recognized danger exists in using a "culture-fair" test, in that it may offer no real advantage for the culturally deprived
individual. In a study by Willard (1968), Negro Ss were compared on the Cattell Culture Fair Intelligence test, and the Academic Promise tests in addition to scores on the WISC. Results suggest that Negro children are not at any appreciable advantage in taking the Cattell over the other tests. Similar results were shown in comparing the Stanford-Binet. It is concluded by the author that the bright Negro child does well on either a culture fair or the usual ability and intelligence tests, while those who are less well endowed do poorly on either type.

According to Halpern (1974), and Jorgensen (1973), test developers and administrators have not confronted the problem of cultural bias as illustrated by Darlington. Not only are IQ tests criticized from the standpoint of their general utility, but they may be used to support existing beliefs regarding the genetic inferiority of some groups or populations.

Studies have sought to determine the degree to which specific IQ test are biased for a particular group. Several of these approaches have included an item analysis to determine whether certain questions are significantly more difficult or unfair for a particular group. Jensen (1974) in 3 studies examined the cultural loadings on the Raven's Progressive Matrices and the PPVT. Ss were over 6,000 Anglo, Black, and Mexican American children in 3 California school districts. Although there were large mean differences between the groups, there was little difference in the rank order of item difficulties. While a small Ethnic-Group*Item interaction was shown, primarily for the PPVT, this was attributed to differences in mental maturity since these differences were perfectly simulated by comparisons between older and younger white
Cultural bias was only clearly shown for the Mexican group on the PPVT. The author concludes that there is no support, on the basis of this research, that the PPVT and the Raven are culturally biased for blacks.

Chovan (1970) examined the performance of two culturally divergent groups on a culture-free test. Black children from a lower SES and white children from a middle SES were given the Kahn Intelligence tests: Experimental form. The optional scales of Recall and Motor Coordination were used in addition to the main scale. Results from the study suggest to the author that intellectual and order operations may be a source of difficulty and possible test bias as well as verbal and cultural elements.

Persaud (1972) administered the Cattell Culture Fair Intelligence test, the Raven's Progressive Matrices, and 2 Czechoslovakian measures including a number series test and an orientation test. The Ss were 10- to 12-year-old Swedish children. The Ss were placed in groups which were separated by SES and the educational levels of the parents. In three out of the four tests there was a significant mean difference in favor of the advantaged group.

Long (1974) sought to determine the extent to which the WISC is culturally biased relative to the Black Intelligence test for Cultural Homogeneity (BITCH). The Ss consisted of 30 black students who were enrolled in EMR classes. The Ss did not do significantly better on the BITCH test and the author concludes that EMR students will do poorly regardless of cultural specificity, which is incorporated into the IQ test.
Davis (1974) compared performances of Black, white, and Mexican youngsters on the Stanford-Binet and the McCarthy Scales of Children's ability (MSCA) to determine whether the latter instrument would provide productive information without some of the Binet's weaknesses. The author concludes that MSCA yields comparative scores to the Stanford-Binet but has administrative and content advantages.

Armstrong (1972) conducted an inquiry into evaluations of test bias. For the research, members of three cultural minorities were asked to respond to a set of items similar to those given on IQ tests. The participants were then asked to evaluate each type of test item which regard to its fairness and appropriateness for their particular minority. Significant reliability was obtained for each of the groups, while they differed significantly in their rating patterns. A group of Anglo-Americans was asked to evaluate the items for bias relative to each of the groups. There was only limited agreement between what the minority groups thought was bias for their people and what the Anglo group thought was culturally specific. Minority group members agreed that factors as high verbal facility, inappropriate material, or tapping untaught skills were variables which contributed to cultural bias on the tests. The author suggests that test makers may not be the ones who are best able to determine what is biased for any particular group.

Norm Comparisons. Another approach that has been taken to resolve discrepancies which occur, between the scores of whites and Negroes, is that of norm comparisons. This requires an assumption of no inherent differences between the groups and necessarily puts the onus for disparity on environmental and cultural factors. Sekyra (1968) analyzed differences
which exist between IQ tests when the Ss are evaluated with different norms. Thirty urban and 30 rural Negroes were tested on the Stanford-Binet (form L-M), the Columbia Mental Maturity Scale (CMMS), and the WISC. The Ss did appreciably better when their SB scores were evaluated using Negro norms. This improvement was consistent against all three of the tests including the SB with Caucasian norms. The author concludes that neither the WISC or the CMMS gives an adequate indication of the intellectual abilities of Negroes using current norms.

Kennedy (1969) reports on a reassessment of a representative sample of 1,800 Negro elementary school children who were originally tested on the Stanford-Binet in 1960. Subsequent testing in 1965 showed no significant variations in overall IQ or standard deviation. However, California Achievement test data showed a continuing trend for Negro children to fall behind academically when compared with the national normative sample.

A study by Silverstein (1973, p. 410) considered the possibility of factoral variance for three ethnic groups, blacks, whites and Chicanos. The results from two methods of analyzing subtests of the WISC support the conclusion that this test measures the same abilities of children of all three groups. The author goes on to state however, "The present findings do not imply that it is fair or proper to use the WISC, which was standardized and normed on Caucasian children only, indiscriminately with children from other ethnic groups. They simply suggest that the test measures the same abilities in Anglo, Black, and Chicano children."

In a study of English norms, validity and social differences, Phillips (1968) selected a sample of 11-year-old children to be tested on
the Stanford-Binet as well as other standard tests of ability. The sample was compared with local social and educational characteristics. The results of the study indicate that the published norms for the SB are inappropriate for English children; the SB is correlated with academic achievement; it is greatly influenced by those verbal abilities which differentiate social classes.

Resnick (1971), in taking a somewhat different approach than the previously mentioned research, rescored the protocols of 80 Negro children who had received a complete WISC criteria for an abbreviated intelligence measure. Comparison of the normal and abbreviated procedures for the WISC revealed that some Ss had upward shifts in scored intelligence when using the short form. The author suggests that, since these children were from a sample who were believed to have school problems, that a short form may be inappropriate for this type of population.

Henderson (1973) examined validity and reliability of the WPPSI using lower SES Mexican-American children. While split half reliability was high, predictive validity was not significant. The inference drawn by the author is that the WPPSI may be inappropriate for special program placement purposes with this population.

**Administrator Effects.** Recently considered variables which may influence the outcome of an IQ test involve the relationship of the administrator to the testee, and the race of the administrator. However, studies in this area have been conflicting and no pattern has been clearly established.

In Kinnie (1970) three non-intellective factors were compared to determine effect on WPPSI scores of lower and middle white and black
preschool children. Familiarization with middle class adults similar to the test administrators, language and material used on the WPPSI, and a test-like situation. The first two variables were found to be most effective in increasing test results; however, the scores of the lower class children did not increase to a greater degree than the middle class children as had been expected.

In a study by Jensen (1969) IQ scores of lower SES children were raised eight to ten points by having them play in the office before taking the test. In a related study Palmer (1969) tried to delay testing of middle and lower class black children until they were completely related and understood the nature of the task. According to Palmer, under these conditions, class differences in measured IQ were eliminated.

Kleinfeld (1973) examined the influence of nonverbally communicated personal warmth on the IQ performance of Indian and Eskimo adolescents. Personal warmth was defined in terms of physical closeness, smiling, and a mutually seated posture. The resultant effect of this approach was a significant increase in intelligence test scores.

Sattler (1966) reanalyzed Canady’s (1936) study. The results indicate that, on the first administration of the 1916 Stanford-Binet Ss obtained higher IQs when given tests by members of their own race. On the second administration Ss obtained higher IQs with members of the other race. In addition a Negro-white administration of the test resulted in higher IQ scores than the alternate order. Sattler indicates that the results should be accepted with caution because of problems in the design of the experiment.

In analyzing the effects of examiner race Solkoff (1974) measured anxiety as well. The Sarason Test Anxiety Scale and the WISC were given
to 54 Black and 54 white children by either Black or white examiners. The Ss were all of comparable SES and age. There was no evidence that white examiners depressed the scores of the black children. The only significant Race of Examiner * Child interaction was evidenced by higher achievement for Negro children with a white examiner.

Moore (1974) tested low income, Black, preschoolers on the WPPSI using Black and white female examiners. Each Ss was tested by a black and white examiner. Results indicate that there is a significant interaction between child's performance and examiner's race on the Verbal, Performance, and Full-Scales of the WPPSI. Similarly, a study by Smith (1966) using the Stanford-Binet on 316 Negro children showed that results are influenced by the sex, race, and testing experience of the examiner.

France (1973) pre-taped instructions and questions for the PPVT with Black and white examiners. Over 250 Black and white children completed the PPVT after listening to one of the voices. The differences in voices significantly affect the performance of the white but not the Black Ss. The author concludes this may have been due to several factors including the ability of white Ss to understand the examiner's voice, and/or identification with the examiner's race.

Savage (1972) investigated race of testor * child performance interaction by having 10 Black and 10 white female testers administer the WISC (digit span and block design) to 240 students who were selected on the basis of race, school type, and grade. Multivariate analysis showed the following significant interactions: Black children performed significantly better on the Block Design with Black testors; significant testor-racial effect was not mediated by the nature of the task. White children scored better on both subtests but this was contaminated with the race of testor effect.
Gould (1971) examined the effects of black and white testers on attitudinal and performance measures. The tests used included: verbal and abstract scales of the differential aptitude tests, the Marlow-Crowne Social desirability scale, and others of this type. The results indicate that, while performance was not affected, there was a significant selective effect for both races regarding racial attitudes and authority relationships within the family.

No significant relation between examiner's race and children's performance was found in a study by Barneby (1973). In that study 20 Black and white examiners gave, 80 Black and white children, intelligence tests. A similar study by Wellborn (1973) in which 48 Black and 48 white children were examined by Black and white female examiners, revealed no significant race of examiner * child performance interactions.

Testing the effects of bilingualism on IQ scores, Swanson (1971) compared to groups of matched Mexican-American Ss. One group was given the intelligence test entirely in English and the other in English and Spanish through use of an interpreter. A t-test analysis of the means indicates no significant difference between the two groups.

Pryzwansky (1974) used 70 female Ss of Black and white races to examine possible effects of being tested by Black and white examiners. A factorial design was used to test for possible effects of examiner race, race of Ss, and location of Ss home. No significant interaction was revealed, however the white Ss, as a group, scored significantly higher than the Black Ss.
Section Seven

According to Schmideberg (1969) the ability to respond adequately depends on variables which may not be purely intellectual. These factors may not be taken into account when research is done on intelligence and their contribution to the overall variance may not be discerned. Some of the factors include: The ability to think and act quickly; the capacity to decide and cite answers in often terse and stereotyped manners; all the emotional, social, physical, and educational experiences that may influence performance; familiarity with the subject matter; test taking experience; his responses to the immediate test situation and the relationship with the testor.

Intrinsic Factors. Some studies have taken into consideration non-intellective factors which may significantly contribute to IQ test scores. Gibby (1967) tested Black and white Ss on the California test of Mental Maturity and the Gibby Intelligence Rating Schedule (IRS). Using the latter scale the Ss rated his self-believed intelligence, how others believed him to be, and how intelligent he would like to be. In general, the Black Ss had significantly greater discrepancies between their actual IQ scores and their ratings on the self-scales. According to the author, the magnitude and direction of the differences between the Negro and white Ss was dependent on sex and IQ level of the children.

Posner (1969) administered two self-concept measures to a group of 300 first grade children consisting of whites, Negroes, and Puerto Ricans. The groups were further divided according to SES, intelligence, and sex. Findings include the following: Negative self-images were apparent in low SES, Negro, and low IQ children; low SES, Negro, and low IQ children have greater self-ideal discrepancy than the other Ss; self-ideal
discrepancy becomes more pronounced as IQ decreases. The author suggests that the results illustrate the need for community-based action rather than individual prescriptions. Posner recognizes, as does Schmideberg, that the range of factors encompassed by this problem is vast and indicates that it goes from central nervous system damage to parent-child interaction.

Anxiety and its relation to academic achievement has been explored by McClelland (1973) and others. Their research has generally shown a curvilinear relationship between anxiety and performance on achievement tests. Hawkes (1971) did an extension of an earlier study and investigated relationships between race, SES, and anxiety in black and white upper elementary school children. In general, it was shown that black children from inner city environments score higher than comparable white peers from suburban environments. In addition strong negative relationships are shown between anxiety and: (1) IQ, (2) achievement, (3) teachers' ratings of pupil behavior.

Anxiety was also related to IQ in a study of Negro college students by Atchison (1968). It was hypothesized in that study that mental age is related to drive state and that comparison of scores to achievement would determine whether anxiety is disruptive. Level of anxiety was compared with achievement scores and IQ scores as determined by the Otis Quick Test. In this study anxiety appeared to be positively related to both intellectual and nonintellectual factors for both high and low groups. The author discusses contrasting results of this and others' studies on the basis of differences in experimental characteristics.

Winter (1967) compared students in a vocational rehabilitation program on three different dimensions: ability to score on an intelligence
test, interests, and personality assessment. The WAIS, Kuder, and Rorschach were used to test for these factors. The Ss consisted of black and white males and females who were all in a VRA program. All of the Ss were between 16 and 20 years of age and were classified as having a behavior problem.

Rapport has been shown to be an important variable in test performance (Jensen, 1969). In a study by Vega (1971) practice effects were considered to determine their relevance in IQ test performance. The Bender Gestalt Test was administered to groups of disadvantaged Negro children. The experimental groups received 33 practice sessions with graphic perceptual motor tasks. Although both groups scored lower than established norms the experimental did significantly better than the control-group. Postpractice PPVT scores showed no significant differences in IQ scores thereby limiting the possible effects of greater verbal facility or understanding the test instructions as being a factor in the performance differences. The author concludes that culturally deprived children may do poorly on a performance test of this type because of a lack of experience.

Eichelberger (1970) studied the effects of practice by administering the Otis-Lennon Mental Abilities test on three different occasions, at monthly intervals. Two forms of this test were used. Significant differences in IQ scores were obtained between the first and second administration only. Ss repeating the same test rather than an alternate form did the best on this second administration. Subjects who improved most were from the upper classes, or girls who had high grade point averages.
Klein (1970) investigated the differential effects of anticipated intraracial and interracial intellectual comparison upon the subsequent performance of black and white Ss. The Ss were equated for locus of control (i.e., external or internal), IQ, and SES. The results indicate that differences in instructional set whereby Black Ss were told of differing norm groups that would be used for comparison of their scores did not have a significant effect on performance. However, there were significant relationships for the following variables: Black Ss showed a positive relationship between locus of control and; (1) memory for meaningful materials test, (2) academic achievement. The author suggests that locus of control is a more important variable for black Ss and alteration of fate controlling beliefs is an important area for further research.

**Extrinsic Factors.** While factors intimately associated with an individual may play an important tole in determining IQ test performance, external variables, such as societies' expectations and opinions about the nature of intelligence and its importance, may also contribute significantly to observed relations or differences between groups. While not always susceptible to empirical investigation, these external factors are being examined and discussed to establish their degree of relevance.

Kinnie (1971) tested middle class whites and lower class blacks and whites on the WPPSI under different pre-exposure situations. The results indicate that Ss who are in contact with, adults who are similar to the test administrators, language and materials used on the test, and are presented with a test-like situation, do better than a control group. The first two were the most effective but the changes were limited to the
performance subscale and, contrary to expectations, the scores of the lower class Ss did not increase significantly more than the scores of the middle class Ss.

Burnes (1971) in assessing various factors assumed to be relevant to test performance, i.e., attention, energy, social skill, task persistence, and concern about performance, found that many of the hypothesized factors were not statistically relevant or differed in importance depending whether the Black or white Ss in the study were being considered. Hypotheses concerning attention were not supported, however, 16 correlations were significant for race and SES.

Munday (1970), in critiquing the present uses of tests, suggests that test measures should be used to provide information about the individual needs of the student. He states that test measures thus far have been primarily concerned with a limited range of abilities primarily in the area of verbal skills. He emphasizes that testing must become more relevant to the total American culture and not just a privileged segment of the population.

Gay (1973, p. 340) believes that the abilities of black children are often underestimated, and the value of their existential experiences ignored, "... their attitudes misunderstood, their perspectives disregarded, and their behavior misinterpreted all because the assessment criteria used are derived from a set of cultural norms to which they do not ascribe."

Vera (1971) draws on scientific and cultural information to refute Jensen's claims re: the genetic inferiority of Negroes in the area of intelligence. The position is attacked from the position that existing tests only get a rough approximation of intelligence; that Negroes in
this society are denied equal opportunity which can inhibit their realization of their full academic and intellectual potential; that physical hardships may significantly interfere with the development of certain processes which are important in the ability to do well on "IQ" tests. Brace (1971) takes an even more conflicting position by suggesting that cultural complexity may be inversely related to IQ, which is in marked contrast to Jensen's (1969, 1973) position.

McClelland (1973) argues that IQ tests have been assessed in terms of their predictive validity for school performance. He suggests that a more appropriate measure of intelligence would be gotten by a careful analysis of individuals who are successful in the performance of their responsibilities in differing life situations. In addition he criticizes present validity studies for the extent to which they are correlational, and not capable of establishing causative relationships.

Williams (1970) gives extensive criticism to the use of IQ measures on the black population due to, what he believes are significant cultural differences between blacks and whites. He asserts that blacks do not have the middle class orientation toward life and should not be subjected to evaluative criteria which are concerned with middle class values. He states that differences in the use of language and idioms further handicap a black person when asked to perform on a given IQ test.

Sommer (1970), in commenting on Williams' article, agrees that the tests may be inappropriate for a given segment of the population, but offers a different solution to the problem. He suggests that the people who devise the tests should become more educated as to the biases which exist and either eliminate these concerns or limit the inferences that are made from the tests.
Bennett (1970) goes further in his defense of existing tests. He makes four main points in refuting Williams' claim that they are unfair and improperly classify black children. Firstly, the great majority of these children are culturally deprived and the inferior scores on the tests reflect these disadvantages. Additionally, he points out that these test measures acquired knowledge and it is improper to allege that they are designed to measure innate abilities. Thirdly, he states that the tests are not designed to discriminate against any race or group and that they are created to measure the best performance of the testee.

Clemans (1970) suggests that the problem revolves around the distinction between current knowledge and potential ability. He believes that if the tests are seen as representing current achievement but are not used to make predictions about the individual's capacity to grow, then they may still serve a useful purpose.

Schmideberg (1969) makes far-reaching statements in the area of qualitative differences. She says that quantitative assessments neglect these qualitative variations, although every mind is different. We all have our own style of reasoning. Some people have better judgment or more common sense, others are more able to think in abstract terms, or have more imagination. She goes on to state that "Every individual, race, nationality, period, has characteristic modes of thinking, be they innate or acquired through tradition or training (p. 92)."

Scarr-Salapatik (1971, p. 1278) says that neither the environmental disadvantaged or genetic differences hypotheses may account for the origin of racial differences. "If all black children are disadvantaged to an unknown degree by being reared as blacks in a whitee dominated society, and no white children are so disadvantaged, it is impossible to estimate
genetic and environmental variances between the races. Only if black children could be reared as though they were white, and vice versa, could the effects of different rearing environments on the genotype distribution of the two races be estimated."
CHAPTER III

METHOD

Subjects

The subjects consisted of 100, Black, male juveniles who were confined in the Cook County Juvenile Temporary Detention Center during the month of October 1976. These juveniles were awaiting hearings on a variety of offenses. The population included 175 male juveniles on the first day of October and admission of 257 during the remainder of the month. A total of 432 males were available to qualify as subjects for the study. According to admission sheets 282 of the 432 males were Black leaving the remaining 150 as whites, Orientals, and "others." Specification as to race was initially taken from data sheets contained in the juveniles' admission folders. Children of mixed parentage, i.e., mulattos, Blacks with Spanish surnames, were excluded as possible subjects. Additional screening as to race occurred during the interview portion of the testing where it appeared to either examiner that the child had observable characteristics (morphs) which might indicate a mixed parentage. While this may be considered a crude measure of racial grouping, it was not designed to acquire a "pure" racial sample since, as indicated in section one of Chapter II, no such pure race exists. Blacks of clearly mixed parentage were excluded because of the possible cultural and environmental variations which might accrue to a child of this background.
Subjects were excluded where it appeared to the examiners that they functioned within a mentally defective range of intelligence or suffered from some form of psychological or mental impairment which precluded their being able to respond to the instructions or the tasks so as to constitute a valid test administration. Seven children who received preliminary evaluations were excluded for one of the above reasons. In addition, children were excluded on the basis of admission records if they indicated that the child had previously been institutionalized for any mental disturbance.

The 100 Ss ranged in age from 11 to 16. Fourteen, fifteen, and sixteen-year-olds comprised 81% of the sample studied. On the last day of October the above age groups comprised 78% of the black male population of the detention center, indicating that the age sample selected was representative of the population available.

Experimenters

The Es included the present author and an associate who is a registered psychologist, and has been employed 9 years in the present setting. Both of the Es are familiar with the administration of the WISC-R and the techniques, specifically rapport, necessary to insure a valid administration of the tests. Both of the Es are known to the detention population in their role as psychologists. This existing knowledge was advantageous in the Es being able to quickly establish rapport with the Ss and create a nonthreatening atmosphere for the test administrations.
Materials

The WISC-R is a revised version of the widely used Weschler Intelligence Scale for Children (1949). The revised version is espoused by its authors to be refined in terms of content and standardization and is believed to be more fair to minority group members including Blacks.

The Vocabulary subtest of the WISC-R is the subtest most highly correlated with the Verbal Score of the test (.78 for all ages combined). In addition the vocabulary subtest appears to be a good measure of overall intellectual performance (g) since it is also the subtest most highly correlated with the Full Scale Score (.74 for all ages combined). The administration of the test is straightforward and primarily consists of requesting definitions of orally presented words.

The Block design subtest of the WISC-R is the subtest most highly correlated with the Performance Score of the test (.68 for all ages combined). It is also a fairly good measure of (g) (.68 for all ages combined). The administration of the Block Design subtest is more complex in that a proper mental set or understanding of the task is necessary. According to Taylor (1971) the test appears to measure the reproductive aspect of visual-motor coordination and, like other performance subtests, it appears less effected by cultural influences than the verbal subtests.

Procedure

The administration of the Detention Center was informed of the nature and purpose of the study. Testing of the children's mental ability level and acquiring social information or family histories is consistent with the existing job descriptions of the present author and his associate, therefore no infringements on the rights or privacy of the children occurred.
Each S was tested under similar conditions. It was the intent of the Es to disrupt the general routine of the Ss as little as possible. The period between three and four in the afternoon, after the Ss returned from school, turned out to be the most appropriate time. In each case the E picked up the S on his living unit and conducted the interview and testing in consultation rooms adjacent to the Ss' living area. All of these rooms are similarly furnished having a table and four or five chairs.

After a period of general conversation, which usually centered around how the S was getting along during his stay in the detention center and when he would be going to court, the E indicated to the S that the E was conducting some research and would greatly appreciate the S's help in this matter. It was made clear to the S that his participation was strictly voluntary and neither his refusal nor his scores on the tests would affect his functioning in the detention center or his court case. The Ss were not told the specific purpose of the study but a minimum amount of information, consistent with maintaining rapport, was provided. Two of the Ss refused to participate after preliminary information of this type was given.

After both subtests were administered (in alternating orders to avoid an order effect), information about the size of the S's family and his birth order were obtained. Additional information was acquired regarding parents in the home, occupation of parents (to confirm employment listed on the admission sheets), ages and sexes of siblings, and mother's age. These factors were acquired for possible statistical analysis and evaluation as they might be considered relevant. It was particularly important to obtain accurate information about Parental composition. It was predetermined that only Ss who had lived with at
least one parent up till the age of 11 (the lowest age S in the study) would be used to insure some consistency among the Ss family experiences during important developmental periods. In addition, no distinction was made between half brothers and sisters as long as the siblings were from the same mother as the S; this was to provide consistency between the Ss relative to genetic and environmental maternal factors.

Because of the relationship between SES and IQ (see Chapter II, section four), Ss were limited to those whose parents' primary employment was no more than manual labor. Weschler's (1974) standardization of the WISC-R indicates that educational level is consistent across various occupations. Holding SES relatively constant would therefore limit the possibility that work and educationally related factors would contribute to any observed variance. Where the father and mother were both present in the home neither parents' occupation status could exceed that of a manual labor classification.

With the above qualifications a homogeneous group for SES was obtained. Of the parental occupations acquired for the 100 subjects in the study, 54% were on some form of unemployment or welfare, the great majority of these being ADC (aid to dependent children) recipients. The remaining 46% were employed in manual labor occupations of which 38% were nonskilled jobs. Types of employment included truck drivers, waitresses, gas station attendents, factory workers, cab drivers, and cooks. A statistical comparison was made between the Ss' scores and parents' occupation grouped into welfare and manual laborers to verify homogeneity for SES. The statistics are reviewed in the "Results" section of Chapter IV.
CHAPTER IV

RESULTS

Multiple regression analysis was done to determine the separate and combined effects of the independent variables birth order (BO), and family size (FS) on the Verbal scores (VS), and Performance scores (PS) of the WISC-R. Table I illustrates the relationship between birth order and family size and their effects on Verbal score. The multiple $r$ for the combined effects of birth order and family size is 0.44709 which is significant ($F = 12.12$ for $2/97$ df, $p < .002$). When birth order is held constant the partial for family size is 0.31255 which is significant ($F = 11.84$ for $2/97$ df, $p < .002$). Standardized partial regression coefficients are given under BETA in the table which shows a nonsignificant partial for birth order ($F = 0.78$), and a significant partial for family size of -0.55906 ($F = 11.843$, $p < .002$). The multiple $r$ squared accounts for about 20% of the observed variance of which family size is the only significant contributor.

Table 2 illustrates the relationship between birth order and family size and their effects on Verbal score when family size is held constant and is introduced into the equation first. Multiple $r$s and variances are the same as in Table 1. With family size held constant a partial correlation for birth order is nonsignificant where the coefficient is 0.31255 ($F = 0.784$).
Table 1

Multiple Regression

Dependent Variable VS (Verbal score)
by BO and FS (birth order and family size)

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Beta</th>
<th>Std. Err. B</th>
<th>FS (not in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BO</td>
<td>-0.2025</td>
<td>-0.3197</td>
<td>0.0606</td>
<td>Beta in</td>
</tr>
<tr>
<td></td>
<td>(constant) 6.8662</td>
<td>F= 11.156</td>
<td></td>
<td>Partial</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>-0.5591</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td>-0.3299</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11.843</td>
</tr>
</tbody>
</table>

Enter FS

<table>
<thead>
<tr>
<th></th>
<th>Multiple R</th>
<th>Beta</th>
<th>Std. Err. Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.4471</td>
<td>-0.5591</td>
<td>0.1153</td>
</tr>
<tr>
<td></td>
<td>Anal. of Var. df</td>
<td>Sum of Squares</td>
<td>Mean Square</td>
</tr>
<tr>
<td></td>
<td>Regression 2</td>
<td>54.4816</td>
<td>27.2408</td>
</tr>
<tr>
<td></td>
<td>Residual 97</td>
<td>218.0784</td>
<td>2.2483</td>
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<tr>
<td></td>
<td>Standard Err. 1.4994</td>
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<tr>
<th>Variable</th>
<th>B</th>
<th>Beta</th>
<th>Std. Err. Beta</th>
<th>F</th>
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</thead>
<tbody>
<tr>
<td>BO</td>
<td>0.0911</td>
<td>0.1438</td>
<td>0.1029</td>
<td>0.784</td>
</tr>
<tr>
<td>FS</td>
<td>-0.3968</td>
<td>-0.5591</td>
<td>0.1153</td>
<td>11.843</td>
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<tr>
<td>(constant) 8.0196</td>
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Key: B= Unstandardized regression coefficient

Beta= Standardized regression coefficient
Table 2
Multiple Regression

Dependent Variable VS (Verbal score) by FS and BO (family size and birth order)

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Beta</th>
<th>Std. Err. Beta</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>-0.3122</td>
<td>-0.4398</td>
<td>0.0644</td>
<td></td>
</tr>
<tr>
<td>BO</td>
<td>0.0911</td>
<td>0.1438</td>
<td>0.1438</td>
<td>0.784</td>
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</tbody>
</table>

Key: Unstandardized regression coefficient = B

Beta = Standardized regression coefficient
Table 3 illustrates the relationship between birth order and family size and their effects on Performance score when family size is held constant and introduced into the equation first. The coefficient for the multiple $r$ is 0.20093 which is nonsignificant ($F = 2.04$ for 2/97 df). Standardized partial coefficients are nonsignificant for birth order (0.16054) and family size (0.31288). The $r$ square accounts for only about 4% of the variance and there is no significant relation for either of the independent variables, separately or in combination, for the dependent variable of performance score.

Table 4 illustrates the relationship between birth order and family size and their effects on Performance score when birth order is held constant and introduced into the equation first. The coefficient for the multiple $r$ is the same as in the above (Table 3). The partial correlation for family size when birth order is held constant is $-0.17578$ which is nonsignificant ($F = 3.093$ for 1/88 df).

To determine whether the Ss were homogeneous regarding SES, relative to other potentially significant variables, $t$-tests were conducted. SES was divided into two groups: welfare recipients, and manual laborers. These groups means were compared on the following variables as illustrated in Table 5--Verbal score (VS), Performance score (PS), Verbal raw score (VR), Performance raw score (PR), family size (FS), birth order (BO), and mother's age (MA). All of the mean comparisons between the two SES groups were nonsignificant for the variables considered; this was for both pooled and separate variance estimates.

**Ex Post Facto Analyses**

Table 6 shows correlations between a number of possibly relevant variables which were not considered main effects but were acquired as residuals from the data collection. These factors include--mother's age
Table 3

Multiple Regression

Dependent Variable PS (Performance score) by FS and BO (family size and birth order)

<table>
<thead>
<tr>
<th>Enter FS</th>
<th>B</th>
<th>Beta</th>
<th>Stan. Err. B</th>
<th>BO (not in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>-0.1846</td>
<td>-0.1798</td>
<td>0.1021</td>
<td>Beta in</td>
</tr>
<tr>
<td>(constant)</td>
<td>8.0819</td>
<td></td>
<td>F= 3.273</td>
<td>Parcial</td>
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</tbody>
</table>

Enter BO

<table>
<thead>
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<th>Multiple R</th>
<th>R square</th>
<th>Adj. R sq.</th>
<th>Standard Err.</th>
<th>Anal. of Var.</th>
<th>df</th>
<th>Sum of Squares</th>
<th>Mean Squares</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2009</td>
<td>0.0404</td>
<td>0.0306</td>
<td>2.3758</td>
<td>Regression 2</td>
<td>2</td>
<td>23.0362</td>
<td>11.5181</td>
<td>2.0406</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Beta</th>
<th>Std. Err. Beta</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS</td>
<td>-0.3213</td>
<td>-0.2139</td>
<td>0.1827</td>
<td>3.093</td>
</tr>
<tr>
<td>BO</td>
<td>0.1471</td>
<td>0.1605</td>
<td>0.1631</td>
<td>0.814</td>
</tr>
<tr>
<td>(constant)</td>
<td>8.2553</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key: B- Unstandardized regression coefficient
Beta- Standardized regression coefficient
Table 4

Multiple Regression

Dependent Variable PS (Performance score) by BO and FS (birth order and family size)

<table>
<thead>
<tr>
<th>BO</th>
<th>B</th>
<th>Beta</th>
<th>Stan. Err. B</th>
<th>FS (not in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BO (constant)</td>
<td>7.3213</td>
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</tr>
<tr>
<td>BO</td>
<td>-0.0906</td>
<td>-0.0989</td>
<td>0.0921</td>
<td>0.2009</td>
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<td></td>
<td></td>
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<td>Beta in</td>
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<td>Partial</td>
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<td>F</td>
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Enter FS

<table>
<thead>
<tr>
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<th>0.2009</th>
<th>Anal. of Var. df</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F</th>
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<td>11.5181</td>
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<td>5.6446</td>
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<td>Standard Err.</td>
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<table>
<thead>
<tr>
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<th>F</th>
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</thead>
<tbody>
<tr>
<td>BO</td>
<td>0.1471</td>
<td>0.1605</td>
<td>0.1631</td>
<td>0.814</td>
</tr>
<tr>
<td>FS</td>
<td>-0.3213</td>
<td>-0.3129</td>
<td>0.1827</td>
<td>3.093</td>
</tr>
<tr>
<td>(constant)</td>
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Key: B = Unstandardized regression coefficient

Beta = Standardized regression coefficient
<table>
<thead>
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<tr>
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<td>Wel.</td>
<td>5.91</td>
<td>1.68</td>
<td>0.23</td>
<td>1.02</td>
<td>0.94</td>
<td>0.04</td>
<td>98</td>
<td>0.97</td>
<td>0.97</td>
<td>0.04</td>
<td>97</td>
<td>0.97</td>
<td>0.04</td>
<td>0.97</td>
</tr>
<tr>
<td></td>
<td>Man.</td>
<td>5.89</td>
<td>1.66</td>
<td>0.24</td>
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<td></td>
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<tr>
<td>VR</td>
<td>Wel.</td>
<td>29.0</td>
<td>6.00</td>
<td>0.83</td>
<td>1.35</td>
<td>0.31</td>
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<td>Wel.</td>
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<td>1.08</td>
<td>0.80</td>
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<td>98</td>
<td>0.70</td>
<td>-0.39</td>
<td>97</td>
<td>0.70</td>
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<tr>
<td></td>
<td>Man.</td>
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<td>2.36</td>
<td>0.35</td>
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<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PR</td>
<td>Wel.</td>
<td>27.1</td>
<td>11.0</td>
<td>1.51</td>
<td>1.19</td>
<td>0.55</td>
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<td>98</td>
<td>0.66</td>
<td>-0.44</td>
<td>98</td>
<td>0.66</td>
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<tr>
<td></td>
<td>Man.</td>
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<td>1.47</td>
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<tr>
<td>FS</td>
<td>Wel.</td>
<td>7.06</td>
<td>2.74</td>
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<td>1.03</td>
<td>0.90</td>
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<tr>
<td>MA</td>
<td>Wel.</td>
<td>37.9</td>
<td>6.60</td>
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<td>0.67</td>
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<td>96</td>
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<td>-1.07</td>
<td>96</td>
<td>0.29</td>
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<td></td>
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<tr>
<td>BO</td>
<td>Wel.</td>
<td>4.94</td>
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<td>0.38</td>
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<td>0.79</td>
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<td>98</td>
<td>0.96</td>
<td>0.05</td>
<td>97</td>
<td>0.96</td>
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<tr>
<td></td>
<td>Man.</td>
<td>4.92</td>
<td>2.69</td>
<td>0.39</td>
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</tbody>
</table>

Key: VS = Verbal Score  
PS = Performance Score  
PR = Performance Raw Score  
MA = Mother's Age  
FS = Family Size  
BO = Birth Order  
VR = Verbal Raw Score  
Wel. = Welfare  
Man. = Manual Labor
Table 6

<table>
<thead>
<tr>
<th></th>
<th>BO</th>
<th>MA</th>
<th>YS</th>
<th>ASM</th>
<th>OMA</th>
<th>OFE</th>
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<tbody>
<tr>
<td>VS</td>
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<td>-0.062</td>
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<td>0.361</td>
<td>0.149</td>
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<td>PS</td>
<td>PCorr.</td>
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<td>-0.073</td>
<td>-0.003</td>
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<td>PCorr.</td>
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<td>0.408</td>
<td>0.052</td>
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<td>0.259</td>
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<td>PR</td>
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<td>-0.095</td>
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<table>
<thead>
<tr>
<th></th>
<th>YM</th>
<th>YF</th>
<th>BNO</th>
<th>SNO</th>
<th>BNY</th>
<th>SNY</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS</td>
<td>PCorr.</td>
<td>-0.108</td>
<td>-0.035</td>
<td>-0.260</td>
<td>-0.034</td>
<td>-0.051</td>
</tr>
<tr>
<td></td>
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<td>0.268</td>
<td>0.422</td>
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<td>PS</td>
<td>PCorr.</td>
<td>0.088</td>
<td>-0.097</td>
<td>0.108</td>
<td>0.029</td>
<td>-0.063</td>
</tr>
<tr>
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<td>0.435</td>
<td>0.360</td>
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<tr>
<td>VR</td>
<td>PCorr.</td>
<td>-0.119</td>
<td>0.169</td>
<td>0.100</td>
<td>0.065</td>
<td>-0.050</td>
</tr>
<tr>
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<td>0.169</td>
<td>0.283</td>
<td>0.355</td>
<td>0.387</td>
</tr>
<tr>
<td>PR</td>
<td>PCorr.</td>
<td>0.074</td>
<td>-0.105</td>
<td>0.075</td>
<td>0.004</td>
<td>-0.106</td>
</tr>
<tr>
<td></td>
<td>sig.</td>
<td>0.336</td>
<td>0.274</td>
<td>0.335</td>
<td>0.492</td>
<td>0.272</td>
</tr>
</tbody>
</table>

Key: PCorr. = Partial Correlation Coefficient
      sig. = Significance Level
(MA), average spacing between siblings (ASM), younger siblings (YS), older males (OMA), older females (OFE), younger males (YM), younger females (YF), years from next oldest (BNO), sex of next oldest (SNO), years from next youngest (BNY), sex of next youngest (SNY).

Partial correlations were obtained for the above factors and Verbal score, Performance score, Verbal raw score and Performance raw score, while controlling for family size and age. The verbal and performance raw scores (VR, PR) were analyzed in addition to the scaled scores to determine whether scaling had confounding effects on the main variables considered. The age factor was used to control the raw scores for this group independent of the normative scaling. With family size and age controlled the independent variables were not significantly related to the dependent variables. This indicates that family size was the controlling source of variance for the analyzed factors.

Figures 2, 3, and 4 depict scattergram analyses for Verbal score, Performance score, and Verbal-Performance score in relation to family size. The correlation, which is a simple $r$ is significant at the .00002 level for Verbal score in relation to family size. The simple $r$ is non-significant for Performance score and family size, the combined result for Verbal score and Performance score (VPS) is significant at the .002 level. Additional characteristics including the slope, intercept, variance, and standard error of estimate, are contained in each figure for the three variables.

Histograms are plotted in Figures 5, 6, and 7 to illustrate the degree to which the Verbal score, Performance score, and Verbal-Performance score for this sample approximate a normal curve. For Verbal score shown in Figure 5 the kurtosis is -0.375 and the skewness is 0.476.
### Scattergram for Verbal S and FS

**Verbal score and family size**

<table>
<thead>
<tr>
<th>VS</th>
<th>2</th>
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**Corr. R** = -0.424  
**R sq.** = 0.179  
**sig.** = 0.00002

**Stand. Err.** = 1.463  
**Intercept** = 7.876  
**Slope** = -0.298  
**N** = 87
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Scattergram for PS and FS (Performance score and family size)

Corr. R -0.114
R sq. 0.013
sig. 0.146
Stand. Err. 2.355
Intercept 7.792
Slope -0.118
N= 87
Scattergram for VPS and FS (Full scale score and family size)

Corr. R -0.030
Stand. Err. 1.504
R sq. 0.092
Intercept 7.833
sig. 0.002
Slope -0.208
N= 87
Figure 5

Frequency Distribution for VS (Verbal score)

Mean 5.900  Std. Err. 0.166  Median 5.658
Mode 5.000  Std. Dev. 1.661  Var. 2.758
Kurtosis -0.375  Skewness 0.476  Range 7.000
Figure 6

Frequency Distribution for PS
(Performance score)

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<th>Mean</th>
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<td>Std. Dev.</td>
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<td>Var.</td>
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<td>Range</td>
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Frequency distribution for VPS

Full scale score

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<td>10.5</td>
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Mean: 6.390
Mode: 7.000
Kurtosis: -0.606
VPS score Std. Err.: 0.164
Std. Dev.: 1.640
Var.: 2.690
Skewness: 0.266
Range: 7.500
For Performance score shown in Figure 6 the kurtosis is -0.319 and the skewness is 0.365. For Verbal-Performance score shown in Figure 7 the kurtosis is -0.606 and the skewness is 0.266. Other measures of the frequency distribution for the above variables included in Figures 5, 6, and 7 are: the mean, mode, standard error, standard deviation, median, and variance.
The results indicated in the previous chapter must be evaluated in light of alternative explanations which suggest varying implications regarding the nature of intellectual development and appropriate areas and methods for further research; consideration of these factors is the concern of this chapter.

Specific predictions based on a confluence model appear to have somewhat limited utility for predicting the specific relationships between a black, male, juvenile delinquent population and performance on two subtests of the WISC-R. Additionally, contrary to the predictions of a restricted environment theory espoused by the present author, family size appears to be a relevant variable in assessing effects of family makeup on verbal performance. Before discussing the possible implications these results have relative to population differences or the nature-nurture controversy re: intellectual development, it is important to consider the significance of the observed relationship between birth order and family size.

Multiple regression analysis indicates that family size continues to significantly affect verbal performance when birth order is held constant while the converse is not true. The immediate question is the extent to which this form of statistical analysis is appropriate in light
of the observed degree of correlation (.826) between birth order and family size.

In cases of multicollinearity the higher the intercorrelation, the less the reliability of the relative importance indicated by the partial coefficients. The confounding of these variables appears to be causally related in that one variable circumscribes or completely defines the limits of the other; while the other factor only partially defines the range of the first factor. Specifically a family size of 4 sets the limits of possible birth order effects between 1-4, while a birth order of 4 only specifies the lower limit of family size (for this case there has to be at least 4 in the family) but does not set an upper limit as to the size, and therefore negative effect re: verbal score, of the family.

Other statistical methods or experimental designs might be employed to partial out the effects of birth order independent of family size so that possible effects of multicollinearity (i.e., sample fluctuations, or increasing unreliability of partials consistent with increased correlation of variables) would not limit inferences to be made to other samples or populations. Since the combined effects of birth order and family size account for only 16% of the observed variation in this sample, and because the confounding appears to be causally related, the present author believes that a more practical solution is to recognize the real relationship between these two variables and encompass both of them in an appropriate third term. For purposes of this discussion it may be useful to speak simply in terms of the dominant effect for this sample which appears to be family size.
The main effects considered in this study are birth order and family size relative to verbal and performance scores on the WISC-R. Apart from the aforementioned relationship between the two independent variables which will, for purposes of this discussion, be subsumed under the general concept family size, certain assumptions are necessary to compare the relative predictive powers of a confluence model or a restricted environment theory. The Confluence Model makes no reference to variances between individual tests but makes predictions as to culture fair tests, as the Raven Progressive Matrices used in the Belmont study (1973) (high loading on performance abilities) and tests which are considered to have higher cultural specificity (high loading on verbal skills). A warranted assumption is that the major tests in use, i.e., the WISC-R, Stanford-Binet, Raven have an acceptable degree of inter-test reliability. The implication of this assumption is that variances between predicted and acquired results are not due variations in tests but reflect observed differences between groups. The failure to obtain significance between the multiple effects of birth order and family size for performance ability suggest that neither the Confluence Model or a Restricted-Environment theory adequately explain the results. The results may lend themselves to a two-level theory similar to that espoused by Jensen (1969) but with important differences re: assumptions about the relative genetic and environmental contributions.

Jensen's (1969) two-level theory (as referred to in section 4 of Chapter II) postulates that the Blacks and whites have equivalent genetic endowment for level one abilities (i.e., short-term memory, performance tasks). This is supported by measures of infant mental development such as the Bayley scales. However, he believes that there are differences
in abstracting ability (level II) which become apparent as the child reaches school age. Jensen explains the observed correlations between SES and IQ or measured intelligence as a function of genetic selection. He believes that the correlation between SES and intelligence results from the more intelligent individuals in the population moving up the social scale.

A particular concern of this study was to address the question of whether environmental variables would still influence measured IQ when SES was held constant. For the selected population, job status did not exceed a manual labor classification. As indicated in Chapter III, 54% of the Ss selected had a parental constellation (one or both parents in the home) who were on welfare of some type. The remaining 46% were manual laborers of which about 8% could be classified as skilled. As indicated in the Results section, there were nonsignificant differences between these two major groups on relevant variables including the independent and dependent variables as well as mother's age.

The significant relation between family size and verbal score (p < .002) may be particularly meaningful when consideration is given to the fact that other potential sources of variance suggested by the literature were either controlled in terms of the population selected (i.e., race, sex, age, SES) or analyzed subsequently in terms of an ex post facto analysis (i.e., mother's age, spacing, scaling, older and younger siblings, sex of siblings). One area of potential interest referred to as family constellation (FC) could not be properly analyzed. This factor related to the presence of the mother or father in the home but was confounded with SES. No attempt was made to report ex post facto analysis in light of this confounding.
If, in Jensen's terms, level II ability is the primary source of variation between black and white groups, and if this level is susceptible to variations due to environmental influences (as is suggested by the present study) may we not then postulate that some continuing unknown proportion of the one standard deviation difference between the mean IQ scores of black and white groups is attributable to environmental factors. In this context it is particularly relevant to note that the one standard deviation is equivalent to 15 IQ points on the WISC-R. For the select population studied the range in mean IQ scores on the Vocabulary sub-test of the WISC-R, for a family size of 2 through 10, is 10 points.

Limitations

Some of the techniques used in this study to reduce the possibility of intervening or confounding variables may necessarily result in limitations regarding inferences or generalizations to other populations. In the case of intellect measurement the majority of studies have suffered from the confounding effects of race, SES, sex, and questions about the culture fairness of tests (particularly those which have high loading on verbal skills). In this study it was considered of primary importance to determine as closely as possible the actual relationships between the independent and dependent variables, this resulted in the use of a highly select population of youngsters who were homogeneous as to race, sex, and SES. Additionally, these Ss' scores were compared to the predictions of an existing model (the Confluence Model of Zagonc [1975], based on the Belmont study [1973]) instead of a control group (i.e., a group of white males of a similar SES background) which might have introduced differences due to cultural specificities in the tests. The results suggest
good internal consistency, particularly for the combined effects of birth order and family size relative to the dependent variables. The extent to which these results are applicable to other samples or populations is the concern of this section.

The question may be raised as to whether this group of Ss is properly representative of the U.S. population so as to constitute a refutation of the Confluence Model to this group relative to the population on which it was based (19-year-old boys in the Netherlands who were born during the Dutch famine around 1944). No such inference is appropriate or intended. Realistically the question may be raised as to whether the Ss are representative of a comparatively broad range of individuals as to make meaningful comparisons.

The Ss in this study have a prorated IQ score mean of 82 (Verbal and Performance combined). While this is significantly different than the average mean on national norms (100 is the average for the WISC-R), it is very close to the average score of blacks in the same national sample (mean score of 85). Limitations that may exist relative to comparing the group studied to normative populations may not lie in differences between one tail of the normal curve and the rest, but a realization that different factors in the environment may have different qualitative or quantitative effects on distinct populations, i.e., black vs. white groups. A criticism which directs itself to whether the Ss are the lower end of a continuum, as opposed to a separate group which is subject to different environmental conditions and test biases, does not take into account strong evidence to the contrary.

A question may be addressed to the problem of cultural bias on the tests used. This is a realistic concern and is referred to in section six
Chapter II. However no specific comparison group was used which might have confounded test bias with the effects of family size. The discrimination due to test bias which may occur in this population is effective relative to comparisons with national norms but the relationship between family size and Verbal score is not affected under the assumption that all of the Ss are equally biased.

Ultimately the ability to generalize the results of this study to other samples or populations is not limited so much by the small sample size, the use of inferential statistics, the lack of an appropriately definable control group, the apparent causal relationship and confounding which occurs between birth order and family size, or any other criticisms which relate to the design or assumptions of the study, but the realization that factors may be differentially related in their importance to intellectual development for different groups or sub-groups. Studies as Mercer (1972) have recognized this problem, and Anastasi (1956) has indicated that family size effects may not be as relevant to higher SES groups (it is relevant to note that race and SES have been confounded in a great many studies in this area)

The present author believes that research in this area should not be directed toward broad range statements or positions which fail to account for the presently observed differences in test performances between groups. Appropriately defined sub-groups which appear to be similar on relevant variables re: intellectual development will be less subject to confounding and may ultimately lead to more valid inferences concerning causative relations. The implications of this study will be addressed within this context.
Implications

The most apparent and potentially significant result of this study is that an environmental variable (family size) has been shown to be significantly related to a subtest of the WISC-R which is highly correlated with, what Jensen refers to as, level two ability. Previously this ability has been postulated by Jensen and others as being predominantly under genetic control. This genetic control is conceived of as selectively moving individuals with higher ability up the social scale thereby implying that any causative relation between SES and intelligence is unidirectional with intelligence generating positive increases in SES. In the present study SES was held constant thereby limiting inferences re: natural genetic selection. The only genetic argument that could be raised against family size as being an environmental variable which effect IQ would be that genetically inferior adults had more children and that for some reason maintained the same SES as more intelligent adults with less children.

A more plausible and parsimonious explanation of the effects of family size on intelligence is given by studies as Kagan (1969) which suggests that lower intellectual development may be attributable in part, to a defective mother-child interaction. This is particularly true in light of the close association between level II abilities and language. Family size necessarily limits the amount of time that a mother can spend with any given child.

The potential influence on the mother, regarding the intellectual development of her child, is clearly illustrated in the Eyferth study (1961) (section 3, Chapter II). Unless one is willing to postulate that level II abilities are strictly carried through the mother, this study
strongly suggests that maternal influences are more significant to the intellectual development of the child than the race of the father.

It may be that family size, for this particular group, becomes particularly important because of diminished environmental opportunities to which the race and social class of the Ss in this group are subject. This may account for studies (i.e., Coleman, 1966) which suggest that other environmental variables as school are more important to black, poor children than white middle class children.

Directions for Further Research

It is the author's opinion that the continued use of intelligence tests is only justified to the extent that research is aimed toward a better understanding of the environmental variables which affect intellectual development. Too little is known or understood about population differences, biases, and the meaningfulness of the IQ scores themselves, to use them as a means of discriminating individual's for purposes of higher education and employment. This position is not taken to limit their use so much as it is taken to improve their usefulness.

Understanding which factors positively contribute to intellectual development can serve to ameliorate conditions which are limiting individual's or groups from recognizing their full intellectual potential. A recognition that different sub-groups in a population may be subject to differing environmental contributions of relevant factors will enable research to be conducted that will come closer to inferring cause and effect relationships. It is within this frame of reference that the present research has been conducted. Its ultimate contribution will depend upon how it has successfully delineated the problem and pointed a direction for meaningful research.
SUMMARY

This study examined the effects of birth order and family size on the scores of the Vocabulary and Block Design subtests of the WISC-R. The Ss (n=100) were Black, male juveniles between the ages of 11-15 who were awaiting hearings on juvenile offenses.

Predictions were based on a Confluence Model proposed by Zajonc (1975) from an analysis of the data in Belmont (1973). This model suggested that significant effects for birth order and family size would exist for performance and verbal skills. Alternately, the present author, using a Restricted-Environment theory, suggested that the beneficial effects of being an earlier born child were time and situationally dependent and that the manifestation of superior verbal skills for these children also depended on positive school experiences. Additionally, the Belmont (1973) study indicated a decreasing effect for family size on test performance as the socioeconomic level of the child decreased, it was therefore predicted that the Ss from the selected population, being from lower SESs, would not be affected on their test performance relative to family size.

The results indicate that family size is significantly related to performance on the Vocabulary subtest but not the Block Design subtest of the WISC-R. No independent effects were shown for birth order relative to verbal or performance abilities. Ex Post Facto analysis of family
related variables including mother's age, younger siblings, average spacing between siblings, number of older males and females, number of younger males and females, years between next oldest and next youngest, sex of next oldest and next youngest, were all nonsignificantly related to Vocabulary or Block Design performance when family size was considered.

The results were explained in terms of the relativity of effects for similar environmental variables on different populations suggested by the research of Anastasi (1956), Scarr-Salapatek (1971), and Mercer (1971). The implications for limiting inferences on IQ test scores between populations was discussed, and directions for further research were suggested in light of these findings.
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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given final approval by the Committee with reference to content and form.

The dissertation is therefore accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May 5, 1977
Date

Joy Rogers
Director’s Signature