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NATURE-NURTURE AND INTELLIGENCE

*From the Institute of Child Welfare,
University of Minnesota*

By

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Worcester, Massachusetts
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I

INTRODUCTION

THE PROBLEM

Variation in human intelligence is universally recognized. But experimentation to discover the causes which affect this variation has moved slowly. The reasons are obvious. First, conditions which permit the control of either heredity or environment are difficult to secure, and secondly, our tools for measurement are limited and crude. Although identical twins provide an absolute control of heredity, their separate location in diverse environments is rare. Experimentation involving the control of environment, on the other hand, is not entirely possible. Measures are available for only certain of its features. For its dynamic attributes we have no measures. Hence, what may appear to be similar environments are only approximately identical. However, the individual mental examination has been demonstrated to be fairly reliable of what may be called test intelligence.

The present investigation approaches the problem by a comparison of two groups of children living in approximately identical environments. In one group, the children are unrelated by blood or marriage to the persons shaping the environment. They are adopted children. In the other group, the children are the offspring of the persons who have shaped the environment. Both heredity and environment are operative in the latter group, while in the former, only environment.

Resemblance as expressed by means of the correlation between attributes in the home and test intelligence of child will constitute one type of analysis. Presumably the magnitude of the correlation between adopted children and their foster homes is a function of environment. In the case of parents and true children, it is a function of heredity and environment combined.

A comparative analysis of mean intelligence with cultural levels will constitute a second type of analysis. Since, as will subsequently be shown, the mean intelligence of the two groups of children is almost identical, marked contrasts in intelligence under constant environmental conditions would place the burden of causation on heredity.

If random placement of adopted children exists in each social stratum then variation from the mean intelligence of the group may be assigned to environmental diversity. Since the homes in both groups of children represent an equal spread on the cultural scale from high to low, we may assume that the nurture factor is equally potent in the determination of final variance in IQ. If the genetic variation in intelligence of each group of children corresponds to the variation measured by our test of intelligence, then the contribution of environment toward final variability in IQ of adopteds would be definitely increased, since they are somewhat less variable than the children reared by their own parents.

It should be emphasized that whatever trends and conclusions can be found in this study are valid only

for populations as homogeneous in racial extraction, social standards, and educational opportunities as that from which our subjects are taken. The distribution of homes of the children in this investigation are probably somewhat skewed toward a superior level. Adoptive homes of even the lowest occupational and economic levels are undoubtedly superior in respect to other traits, since society's control and imposition of standards on this type of home is much greater than on the ordinary home. The educational requirement adhered to in matching our adoptive homes with homes in the general population would tend to raise the environmental and genetic level of the homes of the latter group. This would be particularly true in the lowest occupational groups. In the main, the homes were as variable in essential features as homes of an American urban white population. Clearly they were not as variable as if the homes of southern negroes and poor mountain whites had been included. In consequence, home environment cannot be expected to have as large a proportional effect upon the mental differences of the children studied as though they were being reared in unselected families.

However, attention should also be drawn to the fact that the distribution of inheritable mental capacity of the children in this investigation was probably skewed toward a superior level. No children of the idiot or imbecile grade are included. The true parents of the adopted children were somewhat superior in cultural status to parents of dependent children in general. Hence, heredity cannot be expected to contribute as

large a proportional influence to the mental differences of the children as though a greater variation in genetic intelligence was included. Since environment was equally variable in both the experimental and control populations, and since our sample of parents and true offspring (control population) consistently yielded coefficients of resemblance of .50, it is fair to assume that no serious understatement of the general influence of environment exists in our experimental data.

II HISTORICAL REVIEW

EARLIER STUDIES

Previous to the present investigation, adopted or foster children have twice been used in major studies of nature-nurture and intelligence. Burks (1) of Stanford and Freeman (2) of Chicago published their notable investigations in 1928. In fact, the discrepancies between the results of their investigations stimulated the present research.

Burks undertook a comparative analysis of foster parent-foster child resemblance and true parent-true child resemblance. The children of her two populations were matched for sex, age, and occupational status of father. For the foster group she found consistently low correlations, averaging about .20 between the intelligence of foster children and various attributes measured in their foster homes; while for her control group of true parents and children the coefficients for the same factors were consistent with those established for filial resemblance in physical traits, i.e., about .50. The simultaneous operation of heredity and environment is posited as the explanation for the latter, while the operation of environment alone is offered as the explanation of the coefficients between foster parents and children.

The logical force of the last inference hinges on the freedom of her foster group from the probability of selective mental resemblance in placement. If mental resemblance between foster parents and children ob-

tains, then the relationship exhibited may be due to it rather than to any effect of environment.

Burks circumscribed her foster group by limiting it to children who had been adopted previous to the age of 12 months. Thus the possibility of precise judgments of mental ability on the basis of overt behavior was definitely minimized. Further, she restricted her population to the white race and excluded south European and Jewish children. From her analysis of the social data available on family background, she concluded that the possibility of selective mental resemblance between foster parent and child on the basis of cultural status did not exist.

In contrast to the low coefficients of correlation between test intelligence of child and the foster home found by Burks, Freeman secured coefficients that ranged from .32 to .52 when certain subclassifications were used, and .48 for his entire population. From this evidence he concludes that environment is capable of exercising an influence on mental ability commensurate with that established for true parent and child in which both heredity and environment are operative.

Although Freeman's method was essentially the same as Burks's, his experimental group was not matched with a control group. His foster population also differed considerably in composition. It was practically double in size (401); age at placement ranged from 6 months to 17 years, with the mean at 4 years, 2 months; 8.47 per cent were negro children; four years' residence in the foster home in which the child was located permitted admission into the experimental group.

The possibility of superior foster parents selecting initially bright children was considered a small factor in the relationship, by the author. Arguments were advanced in support of a negligible selective influence because: (1) in 82 per cent of the cases no mental test had been given before placement; (2) adequate family histories of children were not available by which their mentalities might have been estimated; (3) the average age (4 years, 2 months) at which these children were placed in foster homes precluded dependable estimates of mental ability from observable behavior; (4) when Negro children were omitted, the coefficient of correlation between IQ and foster home rating remained practically the same; (5) when 156 children, for whom it would have been least possible to estimate their intelligence since they had been placed under the age of 2 years, were considered independently, a coefficient of $.52 \pm .04$ was secured between test intelligence and foster home rating; (6) when 59 children for whom no histories were available were considered separately from the entire group, a correlation of $.50 \pm .06$ between test intelligence and foster home rating was obtained.

In considering Freeman's explanation for the absence of selective placement in his data, one would promptly agree that estimates of mental ability in which no objective test data enter are distinctly limited. At age 4 years, however, the possibility of estimates of mentality from observable behavior is not remote, especially with children who have been under observation for any length of time. According to the

author's tables, the legitimate children, who constituted 65 per cent of the total foster group, were known to the placement agency and cared for in its receiving home or in a temporary boarding home before placement in permanent foster homes for a period of 11 months, on the average. The illegitimate children, who constituted 35 per cent of the group, were known and under care for a period of 3 months, on the average. The mean age at permanent placement for the legitimate adopted children was 5 years, 8 months; for the illegitimate children, 1 year, 7 months, and as previously stated the average age at placement for the entire group was 4 years, 2 months.

Whether the family histories in the Freeman population were sufficiently complete to forecast the potentialities of the children can be seriously doubted. Nevertheless, the amount of information reported caused the author to conclude that "the foster children came from inferior homes and had a heredity which was decidedly poor." It is possible that these same data supplemented by other unrecorded information influenced the placement agency in its choice of foster homes. In so far as this occurred, the reported coefficient of correlation between test intelligence of children and foster home rating is weighted by selective placement. If all sources of selective placement were removed in the Freeman population, then the correlation $.48 \pm .03$, found for test intelligence and foster home rating when Negro children were omitted, would stand as substantial evidence in support of the influence of environment on the mental development of children.

It is apparent from our analysis of the foregoing studies that a knowledge of selective placement is essential to the interpretation of nature-nurture findings in which foster or adopted children are the subjects. A mathematical expression of resemblance between the intelligence of adopted children and their homes may be a function of either selective placement or environment, or of selective placement and environment combined in unknown proportions. Conclusions cannot be made for either nature or nurture, unless it can be demonstrated that the experimental population is free from the effects of selective mental resemblance.

PRESENT STUDY

In the formulation of the present investigation the problem of mental resemblance between foster parent and child resulting from selective placement received first consideration. Could it be controlled? Obviously if reliable preplacement tests were available the part that selective placement plays in the choice of a home for a child or a group of children could be definitely determined. Moreover, the actual measurement of gains and losses in performance on standard tests of mental ability accordingly as a child is exposed to extremes in environmental stimulation would then be possible. However, such an experiment would assume not only reliable preplacement tests of the child but equally reliable measures of environment. Neither are available. The files of child placement agencies reveal that only a small number of adopted children are

tested in advance of placement. Out of a total of 2449 children adopted in Minnesota between the years 1918-1928, only 98 had been given mental tests. Most of these were tested subsequent to placement. In fact, failure to adjust in the new home generally prompted the examination.

Despite the absence of prognostic tests of mental ability it is highly probable that intellectual promise judged from overt behavior and family history enters into a social agency's recommendations for adoption. The questionnaire replies of 22 child placement workers revealed that 18 regarded *probable intelligence* as of *very great* significance in their judgments of the fitness of a child for an adoptive home, two regarded it of *great* importance, and two of *slight* significance on a scale of five descriptive levels, namely: very slight significance, slight moderate, great, very great significance. Certainly such judgments would fall farthest from the mark in the case of infants. More accurate prediction of future development on the basis of overt behavior could conceivably be made for older children. Indeed very careful placement might result in striking similarity in the intellectual level of foster parents and their adopted children.

The problems that confront the investigator in a research population of untested children placed at older ages are two. First, he must know what elements of history and behavior contributed to the judgment of the child's mental ability and, secondly, whether the bases entering into the judgment were common for the entire group of children studied. Unfortunately, agen-

cy records do not reveal in any consistent manner the bases for their decisions. Hence, the inclusion of children placed at older ages would introduce serious disturbing factors in a research population. Further, any research on adopted children placed at older ages involves the measurement of the influence of the environment previous to the adoptive or foster one under consideration. Because of these reasons it was clear that our experimental population must be composed of children placed in their adoptive homes at as near zero age as possible. Only with such a population could we hope to secure random placement of children and thus reduce the operation of the unmeasurable influence of selective placement. It was recognized, nevertheless, that judgments of intellectual promise on the basis of family history still remained. The ideal experimental population would include only those children whose age at the time of placement is so young as to preclude prediction of future mental development and for whom no evidence of family history is available to agencies or persons placing the children. The complete elimination of family history is impossible, since the number of foundlings is relatively small. However, when the complexity of human inheritance is considered, as well as the infinite variety of factors that enter into the determination of socio-economic status in a competitive society, it is clear that inferences as to the mental ability of an individual from isolated facts of family history are highly unreliable. General trends, however, in mass evidence have been found to be consistent. For example, the progeny of college-trained pro-

professional people are generally above the average in mental ability, while the children of the unschooled laborer are somewhat inferior. A judgment as to the intelligence of a particular infant from a knowledge of his family background nevertheless would be very unreliable. The child may fall far below or far above the average of his parental group. Yet if child placing agencies pursued a consistent policy of relating cultural status of background to that of the adoptive home in all placements, a definite resemblance between foster parents and children would result. The contribution of family history to a judgment of the intellectual level of our experimental children and its consequent weighting of the observed resemblance between adoptive parent and child will be discussed in Section VII.

The imperative need of a check upon our methods committed us to a control group of true parents and offspring from the very inception of the study. Only from a study of a group of children who had been given the same tests and measures as the adopted children could we hope to attach any meaning to the results observed in the adoptive group. High or low correlations between adoptive parents and children, for example, might well be said to be the result of factors peculiar to our measuring instruments. The behavior of any particular group of human beings has meaning only in so far as we know how human beings in general behave. With measurable environment identical for both groups of children, differences in the relationship of child's intelligence to environment obviously must be the result of the presence of a common hered-

ity in the case of true parents and offspring and the result of the absence of hereditary likeness in the case of adopted parents and their children.

III SUBJECTS

SOURCE OF SUBJECTS

Once the decision was made to limit the investigation to children placed in their adoptive homes at a very early age, it was apparent that the records of adopted children deposited in the Children's Bureau of the State Board of Control would be our most complete source for subjects, since the adoption records of the entire state are available there.

Due to the relatively small number of legitimate children that are available for adoption in early infancy, it was deemed better to limit our subjects to illegitimate children. An additional point of significance in favor of illegitimate children was the greater probability of securing a population whose intelligence would be normally distributed. Legitimate children are ordinarily available for adoption only because of serious intellectual and economic inadequacies in their parents or immediate relatives. Illegitimate children, on the other hand, are relinquished for many reasons, namely: the youth of the parents, the social stigma attached to the illegitimacy situation, economic inadequacy of parents, and intellectual incompetency of the parents. The economic inadequacy of unmarried parents is frequently associated with youth, while the economic inadequacy of married parents generally arises from intellectual and personality deficiencies. In general, a population of legitimate dependents appears to come from a narrow socio-economic range, while il-

legitimate dependents come from a more variable family background.

Our first step, then, in anticipation of our research project was the tabulation of the factual items of family history for the illegitimate children adopted in Minnesota during the period 1918-1928. This period was chosen because it would provide children who would be not less than 5 nor more than 14 years of age at the time of the field investigation, 1932-1933. Records were available for 2449 children. Our transcript included information on the personal history of the child, the true parents and the foster parents.

EXPERIMENTAL GROUP, CRITERIA OF SELECTION

In order that the least possible ambiguity exist in our results, the experimental group was limited to:

1. *Children placed in their adoptive homes at the age of 6 months or younger.* (The mean age of placement was 2.5 months) At this early age precise judgments of mental ability on the basis of test performance, physical development, or overt behavior are highly improbable. Further, this criterion assures from early infancy an environment that is no more or less changing in character than that enjoyed by children in general. Moreover, it definitely avoids the difficulties which would arise in attempting to measure the influence of environment previous to the adoptive one under consideration.

2. *Only those adopted children who were known to be of white race, non-Jewish, north-European ex-*

traction. This prerequisite tends to reduce the possibilities of a fortuitous resemblance between adoptive parent and child on the basis of racial regression. In addition it minimizes the possibility of a spurious heterogeneity arising from uncontrolled factors relating to race. Further, it limits the group to one which is similar in composition to the one on which the Stanford-Binet test was standardized.

3. *Children who were not less than 5 nor more than 14 years of age at the time of investigation.* This age range is conceded to give the most reliable test results.

4. *Children reared in communities of 1000 or more.* In this way we attempted to equalize the influence of such environmental factors as churches, clubs, and schools. No farm children are included. Ninety-five per cent of the group have been reared in communities of over 10,000.

5. *Children who were legally adopted by married persons.* Thus we secured a group where the legal relationship and responsibility between parent and child was the same as that of true parent and offspring.

6. *Adoptive parents who were of white race, non-Jewish, north-European extraction.* With this criterion we attempted to reduce the possibility of adventitious resemblance and further reduced the possibility of securing non-English-speaking homes.

By adhering rigidly to the foregoing criteria it is believed that we have controlled the element of selective placement to a point beyond the facilities of earlier

investigators and to the highest possible degree that present day child adoption permits. Fitting the child to the home on the basis of coloring, physique, and religious faith, all of which occur, could hardly give rise to mental resemblance. Selective placement upon the basis of cultural status, however, is still possible. But since the preadoptive records did not reveal the facts on this point, we can only infer its existence or nonexistence from an analysis of the relationship of certain indices of cultural status. Evidence relative to this point will be presented in Section VII.

In our earliest considerations of a population we conceived a research group which would sample the population of adoptive homes distributed from a socio-economic standpoint as male occupations are distributed in the general population. Because of the limited number of children placed in homes of the laboring class this plan had to be abandoned. In its place we accepted all children available in the two lowest occupational groups and secured at least 40 children at every other level. With these numbers we have not only obtained a fair picture of environmental differences contingent on occupational status, but have also secured a fair sample of the selective placement that may operate on the basis of cultural status. A small number at any level might give a distinctly distorted picture.

CONTROL GROUP, CRITERIA OF SELECTION

With the primary purpose of a control group serving as a check upon the validity of our methods, each

adopted child was matched with an *own* child as follows:

1. *For sex.*
2. *Within an age range of plus or minus 6 months.*
3. *Whose fathers' occupations fell in the same group on the Minnesota Occupational Scale.*
4. *Whose fathers' school attainments agreed within plus or minus one school grade level.*
5. *Whose mothers' school attainments agreed within plus or minus one school grade level.*
6. *Whose parents were white race, non-Jewish, north-European extraction.*
7. *Whose residence has been in communities of 1000 or more.*

The problem of matching cases was very arduous and time consuming. The degree to which we have been successful in locating two groups of children living under similar environmental conditions; one, unrelated by blood to the adults rearing them, the other, the offspring of the adults shaping the environment, will be shown by a series of tables and graphs in Section V.

In matching cases for occupation and education, we employed the two most objective indices of cultural status that are available. In 12 cases the educational criterion was not adhered to. It was necessary to be content with agreement in education for one parent. In these cases, however, the educational disparity between the other adoptive parent and his control was

held within the ordinary school groups of elementary, high school, or college level.

A typical match is illustrated by the following example. A lawyer, in the person of an adoptive father who had completed college and whose wife had finished the eleventh grade in high school, might be matched with an electrical engineer of not less than three or more than five years of college and whose wife had completed at least the tenth, but not more than the twelfth grade in high school, provided the sex and age of their respective children agreed.

If environment is dominant, it would seem that the trend of any trait concerning the children and their environment would be similar in direction and magnitude for both the adopted and control populations. Certainly, our adopted children should clearly reveal the relationship of environment to attributes which are not reciprocally affected by the innate tendencies of the child. For example, the occupation of the adoptive father is obviously not a function of the intelligence of the adopted child, while the number of children's books in the adoptive home and the intelligence of the child are reciprocally dependent. The books may be in the home because intelligent children enjoy books. Or the children may be more responsive and alert because the books are in the home. When the age of our children at the time of the test is considered, it is apparent that there are many factors in the adoptive home whose existence is entirely independent of the child and, therefore, whatever relationship exists between these factors and the child may be regarded as

a measure of the influence of environment. The relationship between parent and true offspring, however, is a complex of environment and heredity. Here, for example, the child's intelligence may be not only the result of the quality of the environment that the parents have provided, but also an inherited characteristic from the parents. From the adopted population we should be able to get a measure of the influence of environment; from the control population a measure of the influence of environment reenforced by heredity. Whatever unreliability exists because of imperfections in our measuring instruments will be similarly existent in both populations. Further, whatever the accumulated effect of environment may be, it will be operative in both populations in the same direction since both have enjoyed what might be termed an ordinarily continuous environment.

IV METHOD

APPROACH TO SUBJECTS

With but few exceptions each experimental and control family was interviewed three times. The first interview was concerned with an explanation of the purpose of the study and with the collection of social data. At that time the mother was ordinarily seen alone when the child was away at school.

The second interview was devoted to testing the child. This was done either in the home or at the University. The former was allowed for all cases located outside of Minneapolis and St. Paul and for residents of the latter communities when conditions made a trip to the University impossible. Every attempt was made in the case of the latter to approximate good laboratory standards for individual mental examinations. With but few exceptions the entire control group of children were examined at the schools which they attended. In their situation the study could be explained to the school authorities since there was no danger of disclosing confidential information.

The third interview was given over to a report of the child's test performance followed by the administration of a set of intelligence tests to the parents. This interview was usually held in the evening when both parents could be present. In a small number of cases, the second and third interviews were combined; while one investigator tested the child, the other tested the parents.

The time required to carry out our program with an individual family varied from five to seven hours. Only rarely was it completed in less than five hours.

The confidential character of our knowledge of the presence of an adopted child in a home demanded that we proceed with caution. Hence the introduction of the study to a parent followed a pattern designed to respect this confidence, as well as to secure the highest possible cooperation. First, a letter which explained the character and extent of the investigation was dispatched. It contained no reference to adopted children.

The Institute of Child Welfare of the University of Minnesota is making a research study of the child in his home environment. Four hundred homes located in various parts of the state of Minnesota have been carefully selected to take part in this study. Your home was among those chosen.

Other than a total of about two or three hours of time no demands are made of parents. A field worker will want to see you and then give your child certain simple ability and interest tests. Most children regard the tests as games and seem to enjoy them thoroughly. The tests will be given in your home or at the University, whichever seems the more convenient. The study is entirely non-commercial. The fullest practical and scientific value of the study will be possible only through the assistance of parents. Your cooperation will be a contribution to an important scientific project.

During the progress of the study parents will be given the results of their children's tests. These should be of considerable interest and value. They will be used for statistical purposes only and without the names of the individuals participating in the study.

Gauging the receipt of the letter and allowing sufficient time for both parents to have perused its contents, inquiry was made by telephone as to whether or not the communication had been received. If the reply was in the affirmative, an opportunity to visit the home in order to explain the study was promptly requested. If the letter had not been received, the study was briefly described and a future communication promised. Reference to the status of the child was avoided in all telephone communications. However, a number of persons (30-35) asked precipitously whether the presence of an adopted child in their home had been the basis of selection. Admitting the inclusion of *adopted* as well as *own* children in the study, a direct answer to the question was usually evaded—not of course with invariable success. However, in most cases we were able to postpone the discussion of the exact basis of selection until the home visit. At that time the basis of selection of subjects, the importance of adopted children in a study such as we were undertaking, and a complete description of our plan was frankly discussed. Even in families where the child had not been told of his adoption and the parents had at first feared that cooperating in our research would disclose the fact, the explanation of the significance of the study along with the assurance that the identity of the individual would be held in strict confidence was sufficient to secure excellent response. For a small number of families who could not be reached directly by telephone, the original announcement letter indicated possible visiting hours. A self-addressed card

on which to record their preference was also enclosed.

One hundred and ninety-four, 84 per cent of the total number (231) of adoptive families asked to cooperate, participated in the study. Thirty-seven families, 16 per cent, refused their cooperation. Twenty-three of these were telephone refusals. Only 14 refused after a personal interview. Although the telephone refusals constitute 62 per cent of the total group refusing, the method was distinctly economical of time. Further, suspicion and antagonism would in all probability have been greater had an investigator appeared unannounced at the home. As evidence of the authenticity of the investigation, the parents had before them a letter on official stationery, signed by the Director of the Institute of Child Welfare.

The reasons offered by those parents who refused their cooperation were the following: a fear that the knowledge of adoption would reach the child, child sensitive about adoption, uninterested in study, and unwilling to have child tested. In the group that cooperated, only 50 per cent of the children had been told that they were adopted. The proportion of children without instruction as to their true status among the refusals is probably greater. Unwillingness to have child tested was given in only three cases. A larger number in this category would probably seriously affect our results. A complete analysis of the entire group that refused cooperation and a discussion of the probable effect of their refusal on our results will be presented in Section VII.

The approach to our control families followed that

used for the adoptive homes. The same announcement letter was used. Due to errors in matching cases, 40 control families over and above those used in our analysis were given partial or complete study. Here the number of refusals was small. Because they could always be replaced by other families that resembled the adoptive family equally as well and who would presumably equally well expose familial resemblance, no description was compiled.

TESTS EMPLOYED AND THEIR ADMINISTRATION

The tests and measures used for both the adoptive and control families were the following:

1. A set of three blanks entitled *The Child and His Environment* covered the family and personal history of the child. Space was provided for specific information as to the identity of the child, the condition of his health, the cultural background of his true parents and for the replies to 88 questions relative to the cultural, economic and social status of the adoptive home. This last category of information constitutes our quantitative measure for environment. All replies were directly recorded in the mother's presence. The questions pertaining to the true parents were almost invariably held over to the latter part of the interview. Occasionally, however, the adoptive parent volunteered the information in advance of any specific questions. None gave the impression of withholding information on these points, although the majority were unable to answer the questions pertaining to the child's family

background. Obviously this section was not pertinent in the case of the control children.

The second blank permitted a description of the home as gleaned from informal conversation with the mother. The child's personality, behavior, his school progress, and a narrative of the circumstances surrounding his selection were the topics usually discussed. These data were recorded subsequent to the interview, but as soon after as possible.

The third schedule designed to contribute to our knowledge of family and personal history was the interest interview with the child. This was usually administered after the mental examination and covered the child's educational and social activities. The questions were asked directly and the replies were recorded immediately.

2. The Stanford Revision of the Binet-Simon Tests as described in Terman's "The Measurement of Intelligence" was administered to all the children. The procedure recommended by its author was rigidly adhered to, i.e., the testing was carried down to a level at which all tests were passed and up to a level at which all tests were failed. For those children who exceeded the limits of the test the correction worked out in connection with the Stanford Study of gifted children was applied. (Terman, 8, p. 42) In order to minimize errors contingent on the personal differences of examiners, a single examiner administered all of the tests to the adopted children.¹ Similarly in the case of the con-

¹Miss Winona Morgan, the chief assistant, tested every adopted child. Miss Amanda Herring tested all of the control children. Both examiners had M.A. degrees in psychology and both were trained in mental testing by Dr. F. L. Goodenough.

trol children a single examiner was used. All tests were checked and rescored by the mental test division of the Institute of Child Welfare.

3. The Woodworth-Mathews "Personal Data Sheet," a questionnaire of 75 questions designed to reveal psychotic tendencies, was given to all children age 10 years and over. Two questions (44 and 45) which pertain to adopted children were blotted from the booklets. According to the author the total number of unfavorable responses provides an index of an individual's emotional stability. Since all other variables entering into our analysis are expressed by increments which increase with favorableness, the Woodworth-Mathews questionnaire was scored for total favorable responses. No claims are made for the validity or reliability of the questionnaire. It is simple to administer and supplies a ready instrument for comparative analysis.

4. The Otis Self-Administering Test of Mental Ability—Intermediate Form A, was given to the parents. The Intermediate examination, designed for grades 4 to 9, was chosen instead of the higher examination designed for high school and college students because of the great difficulty exhibited by 20 parents who tried the higher examination. They found the illustrative questions imposing and in general their "set" to the test situation was one of anxiety. And although our social data subsequently showed the mean schooling of the adoptive parents to be eleventh grade and that of the control parents, tenth grade, the average older adult is unfamiliar with the test situation and

"shys off" anything of this nature that appears difficult. The fact that the test results were to be used primarily for comparative purposes further justified the use of the simpler form.

In order to reduce the fear that might arise from the word "test" the title at the top of each Otis examination booklet was pasted over with a piece of paper resembling in texture and weight that of the booklet. In referring to the test the investigator called it a list of questions. Otherwise its administration adhered to the directions given in the manual. Twenty minutes was allowed for its execution. As in the case of the children's mental tests, each Otis examination was checked for scoring errors. In choosing the Otis the author was influenced not only by the ease with which it can be administered, but also because it would provide a check on Freeman's results since he had used it in his study of the influence of environment on intelligence.

5. The Stanford-Binet Vocabulary Test was given to the parents. Total vocabulary score was calculated on the basis of the subject's responses to the first list of words. Definitions were carefully checked according to the directions in Terman, *The Measurement of Intelligence*. This test was included in our program because of its high correlation with the whole Binet scale and, secondly, because it had been used by Burks in her study of nature-nurture and intelligence.

6. A transcript of the social agency's record of the child and his true parents was made. The items of education and occupation of forbears were rechecked with the original record in order to have available the most reliable information possible on the cultural level of the child's background.

V

DESCRIPTION OF EXPERIMENTAL GROUPS

Our Adopted and Control groups will be described by a series of tables and graphs. The first of the series concerns the children—their age, school grade, and intelligence.

AGE

In Table 1 and Figure 1 age is shown. From these figures, it is apparent that this research concerns two groups of children who are practically identical in age; the mean for the Adopted group is 9.3 ± 2.5 years, for the Controls, 9.4 ± 2.5 years.

TABLE 1
AGE DISTRIBUTION OF ADOPTED AND CONTROL CHILDREN

Age in years	Adopted children	Control children
15	1	4
14	10	7
13	14	17
12	18	16
11	23	23
10	24	24
9	20	22
8	23	28
7	35	33
6	20	15
5	6	5
M	9.3	9.4
SD	2.5	2.5
N	194	194

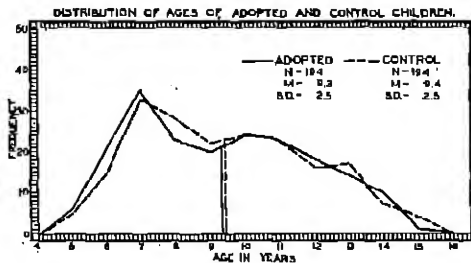


FIGURE 1

SCHOOL GRADE

Although the children were not matched for school grade, the agreement in school attainment as shown in Table 2 and Figure 2 is striking. The mean school

TABLE 2
DISTRIBUTION OF SCHOOL GRADE OF ADOPTED AND CONTROL CHILDREN

School grade	Adopted children	Control children
10	—	4
9	10	5
8	9	8
7	16	17
6	17	19
5	22	23
4	26	23
3	22	27
2	28	25
1	33	31
Kgn.	8	11
M	3.9	3.9
SD	2.5	2.5
N	191	193

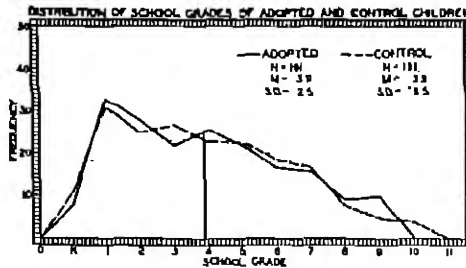


FIGURE 2

grade of the Adopteds is 3.9 with a standard deviation of 2.5; the mean for the Controls is also 3.9 with a standard deviation of 2.5. Hence, whatever may be the influence of environment functioning through the institution of the school, we should expect it to affect the two groups equally.

INTELLIGENCE

The distribution of intelligence test scores is shown in Table 3 and Figure 3. The average IQ of the

TABLE 3
DISTRIBUTION OF IQ OF ADOPTED AND CONTROL CHILDREN

Stanford-Binet IQ	Adopted children	Control children
160-164	0	2
155-159	1	1
150-154	0	0
145-149	1	2
140-144	2	0
135-139	1	6
130-134	6	7
125-129	11	19
120-124	26	13
115-119	21	19
110-114	31	23
105-109	33	21
100-104	23	25
95- 99	21	24
90- 94	6	17
85- 89	10	5
80- 84	0	7
75- 79	1	2
M	110.5	109.7
SD	12.5	15.4
N	194	194

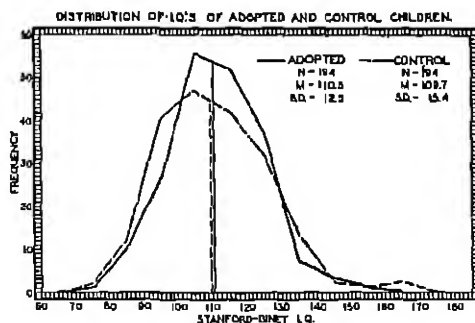


FIGURE 3

Adopted children, as determined by the Stanford-Binet Test, is 110.5, of the Controls 109.7. A statistically

insignificant difference of .8 exists between the two groups.

Although practical identity exists in test intelligence, a consideration of why the averages of the two groups are above those of children in the general population is pertinent. Since it has been demonstrated that girls do better on verbal tests than boys, can the disproportionately larger number of girls in these data, 61% as against 39% boys, have determined these averages? A separate analysis of the test performance of the boys and girls in both populations showed the difference between the sexes to be insignificant. The mean IQ of adopted boys is 109.6, of adopted girls, 111.4. The ratio of the difference to its standard error is 1.02. In the case of the control children, the mean for boys is 110.0, and for the girls, 109.5. Here the ratio of the difference to its standard error is .004.

The next consideration was selection. The probability that it is operative in the Control population is reasonable, since in matching cases on the basis of adoptive father's occupation the number of homes in the upper economic levels outweighs the number of homes in the lower occupational groups. In fact, there are five times as many homes of the professional class as this level appears in the general population, and the excess of homes from the business managerial group is two times their occurrence in the general population, while the proportion of homes in the two lowest occupational groups is about one-half their frequency in the general population. Hence the positive deviation of average IQ is to be expected, since here we have se-

lective heredity and superior environment, both operative.

A further condition which would tend to lift the intellectual level of control children in the lower occupational brackets, and hence raise the general average of the entire group, is the fact that control parents were selected on the basis of their agreement with adoptive parents in school attainment. When this criterion is introduced into groups whose occupation is not dependent upon amount of schooling, as in the case of the unskilled workman, the intellectual level of the group is thereby raised.

What is the evidence of selection in the Adopted group? If we have random placement of adopted children, an excess of homes from the upper economic levels should not have the effect observed, unless it can be ascribed to the influence of environment. Before such a conclusion is warranted, the elimination of unpromising candidates for adoption must be considered. Inquiry into the laws concerning the adoption of children in Minnesota reveals that, since 1917, annulment of adoption is possible if the child develops to be feebleminded, epileptic, insane, or afflicted with venereal disease, as a result of conditions existing prior to the adoption. Annulment because of feeblemindedness occurred in one case that we attempted to locate. How many children were placed out but not adopted because of mental defect we have no way of knowing. Since 1917 a trial period of six months' residence in the home before adoption has been required by law. All of our children have resided five or more years

and all had been legally adopted. Further, since 1925, a child has been regarded as unsuitable for adoption, if one or more of the following obtain: (1) the offspring of incestuous cohabitation, (2) one or both parents feeble-minded or insane and the mental state of the child is as yet undetermined, (3) if the child is crippled or deformed or afflicted with tuberculosis, venereal disease, or other contagious or offensive disease that render his presence a menace to others.

The restriction denying adoption to children of feeble-minded persons until the offspring's intelligence is determined would alone be sufficient to raise the general intellectual level of adopted children. Since all of our children were placed and adopted previous to an age at which reliable tests of mental ability can be made, it follows that there was no known history of feeble-mindedness in their immediate background.

On the basis of the foregoing conditions, we should expect positive skewness in the intelligence level of our adopted children. It should also be noted that in an analysis of the cultural background of 10,000 potential dependent children made by the author and published in *The Journal of Genetic Psychology*, December, 1932, it was found that dependent illegitimate children who were relinquished for adoption had more superior family histories judging from occupation and education of parents than those children retained by their true mothers. Hence, the element of selected heredity appears to be playing a distinct part in the positive deviation of the average IQ of our Adopted children. The part that environment may be playing will be discussed in Section VI.

The environmental indices of our populations include: educational attainment, test intelligence scores, and vocabulary scores for both parents, the occupational status of the fathers and home rating as expressed on a quantitative scale designed to measure urban home conditions.

EDUCATION OF PARENTS

Tables 4 and 5 and Figures 4 and 5 describe the school grade attainment of the two sets of parents. The agreement is marked. The mean in the case of the fathers of Adopted children is 11.2 ± 4.3 , of Controls, 11.4 ± 4.0 . The mean school grade attainment of the

TABLE 4
DISTRIBUTION OF EDUCATION OF ADOPTIVE AND CONTROL FATHERS

School grade completed	Adoptive fathers	Control fathers
21	0	1
20	1	3
19	4	5
18	13	2
17	5	7
16	34	30
15	2	9
14	6	9
13	1	6
12	24	21
11	6	5
10	12	14
9	7	11
8	46	46
7	11	9
6	10	8
5	2	5
4	2	1
3	6	1
2	0	0
1	1	0
	M	11.2
	SD	4.3
	N	193
		193

ALICE M. LEAHY

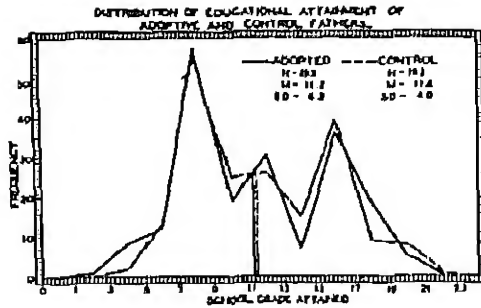


FIGURE 4

TABLE 5
DISTRIBUTION OF EDUCATION OF ADOPTIVE AND CONTROL
MOTHERS

School grade completed	Adoptive mothers	Control mothers
17	0	1
16	20	20
15	4	10
14	11	7
13	6	11
12	45	43
11	11	12
10	15	18
9	8	14
8	50	40
7	6	6
6	5	3
5	7	7
4	3	2
3	1	0
	M 10.5	10.8
	SD 3.1	3.0
	N 192	194

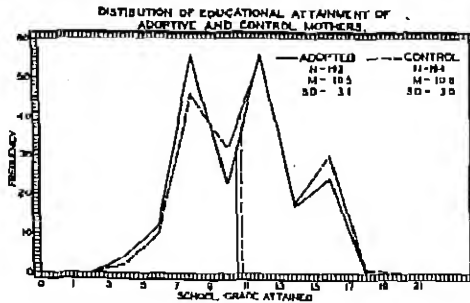


FIGURE 5

mothers of Adopted children is 10.5 ± 3.1 , of Control mothers 10.8 ± 3.0 .

INTELLIGENCE OF PARENTS

The similarity in intelligence test performance of the Adoptive and Control parents is notable. As shown in Table 6 and Figure 6, the mid-parent score for

TABLE 6
DISTRIBUTION OF MID-PARENT OTIS SCORE OF ADOPTIVE AND CONTROL PARENTS

Otis score	Adoptive parents	Control parents
70-74	4	10
65-69	24	24
60-64	24	28
55-59	28	26
50-54	16	12
45-49	27	18
40-44	16	12
35-39	12	12
30-34	9	10
25-29	8	4
20-24	5	1
15-19	1	2
10-14	3	1
0-9	0	0
M	50.0	52.0
SD	13.6	13.1
N	177	173

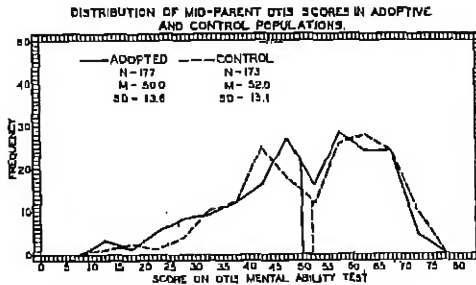


FIGURE 6

Adoptive parents on the Otis test of mental ability is 50.0 ± 13.6 , for the Control parent it is 52.0 ± 13.1 .

VOCABULARY ABILITY OF PARENTS

On the Stanford-Binet vocabulary test the difference in the performance of the two groups of parents is insignificant. The average for the Adoptive parent is 65.0 ± 12.0 , the average for the Control parents is 63.2 ± 12.1 as given in Table 7 and Figure 7.

TABLE 7
DISTRIBUTION OF MID-PARENT VOCABULARY SCORE OF ADOPTIVE
AND CONTROL PARENTS

S.D. Vocabulary score	Adoptive parents	Control parents
85-89	3	6
80-84	19	8
75-79	16	17
70-74	36	23
65-69	31	21
60-64	26	16
55-59	15	27
50-54	15	21
45-49	4	9
40-44	2	7
35-39	2	4
30-34	4	0
25-29	0	0
20-24	1	0
M	65.9	63.2
SD	12.0	12.1
N	174	164

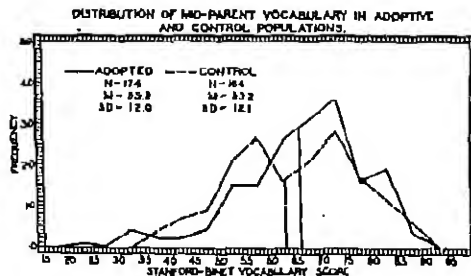


FIGURE 7

OCCUPATIONAL STATUS

Table 8 and Figure 8 show the agreement in home environment as determined by the occupational status of the fathers of our Adopted and Control children.

TABLE 8
OCCUPATIONAL CLASSIFICATION OF ADOPTIVE AND CONTROL FATHERS

Occupational group	Adoptive fathers	Control fathers
I Professional	41	41
II Business manager	40	40
III Skilled trades	44	44
IV Farmers	0	0
V Semi-skilled	45	45
VI Slightly skilled	20	20
VII Day labor	4	4
M	3.1	3.1
SD	1.3	1.3
N	194	194

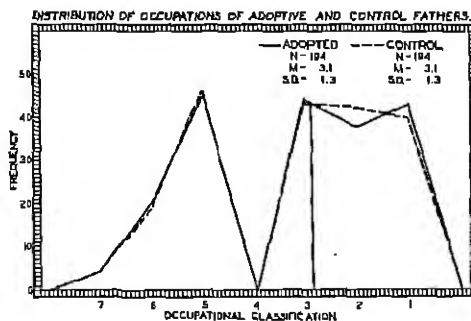


FIGURE 8

ENVIRONMENTAL STATUS

In environmental status score, Table 9 and Figure 9, the adoptive homes show a significant though not very large excess over the control homes, 137.9 ± 54.3 as against 118.7 ± 59.6 . Since this measure is a combined expression of occupational status, education of parents,

TABLE 9
DISTRIBUTION OF ENVIRONMENTAL STATUS SCORE OF ADOPTIVE
AND CONTROL HOMES

Environmental status score	Adoptive homes	Control homes
225-239	8	0
210-224	18	8
195-209	15	13
180-194	16	21
165-179	12	10
150-164	15	19
135-149	13	16
120-134	20	13
105-119	20	9
90-104	13	13
75-89	12	16
60-74	22	20
45-59	7	11
30-44	2	11
15-29	1	8
0-14	0	6
M	137.9	118.7
SD	54.3	59.6
N	194	194

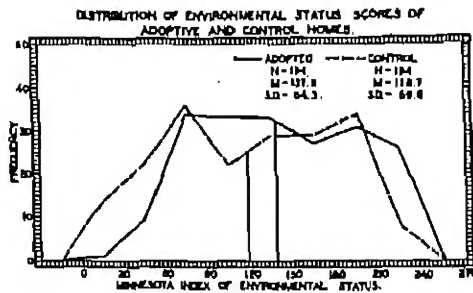


FIGURE 9

economic status, degree of social participation, cultural materials, and child training facilities in the home, and since our Adoptive and Control parents are almost identical in occupation and education, the difference must be in the other factors. The smaller size of the adoptive family no doubt permits greater material

possessions as well as freedom for a greater amount of participation in community activities.

In general it appears that the environment in the Control group is truly comparable to that of the Adopted group. To the extent that the foregoing indices signify similarity in environmental potency the homes of the two groups of children may be regarded as equally stimulating. Conceding our inability to obtain a measure of the stimulating or depressive effect of any one environment for any one child, the general influence in the two groups would be most probably the same. Hence, if environment is dominant, we should expect the magnitude of the relationship between child intelligence and any single index or any combination of indices to be relatively the same for both groups of children.

VI

MAIN RESULTS OF THE STUDY

The relationship between test intelligence of children and various attributes of their home environment is shown in Table 10. Since intelligence and age of

TABLE 10
CHILD'S IQ CORRELATED WITH OTHER FACTORS

Correlated factor	Adopted children			Control children		
	r	P.E.	N	r	P.E.	N
Father's Otis score	.15	.05	178	.51	.04	175
Mother's Otis score	.20	.05	186	.51	.04	191
Mid-parent Otis score	.18	.05	177	.60	.03	173
Father's S.B. vocabulary	.22	.05	177	.47	.04	168
Mother's S.B. vocabulary	.20	.05	185	.49	.04	190
Mid-parent S.B. vocabulary	.24	.05	174	.56	.03	164
Environmental status score	.19	.05	194	.53	.03	194
Cultural index of home	.21	.05	194	.51	.04	194
Child training index of home	.18	.05	194	.52	.04	194
Economic index of home	.12	.05	194	.37	.04	194
Sociality index of home	.11	.05	194	.42	.04	194
Father's education	.16	.05	193	.48	.04	193
Mother's education	.21	.05	192	.50	.04	194
Mid-parent education	.20	.05	193	.54	.03	194
Father's occupational status	.12	.05	194	.45	.04	194

child have been demonstrated to be negatively correlated (in these data, age and IQ for adopted children correlated from $-.17$ to $-.19$, for controls from $-.13$ to $-.18$), age has been partialled out and the relationships are expressed in product moment correlations. Because it was not possible to obtain full information for all the persons participating in the study, the number of cases varies for each correlation.

Although the difference between corresponding correlation coefficients in the Adopted and Control group is consistent and striking, their comparability must be determined before any interpretations are made. The

test of comparability is equal variability. A reexamination of the data in Section V shows almost perfect agreement in the variability of environmental factors entering our correlational table. Equal variability does not exist for test intelligence, however, in the two sets of data. In the case of the Adopted children it is 12.5, for the Control children, it is 15.4. Although the difference is not large, correction should be made if two equally comparable series of coefficients are desired. Since the nature of the curtailment is known and exists in only one trait, the correction evolved by Pearson may be applied.² The corrected correlations are presented in Table 11.

TABLE 11
CHILD'S IQ CORRELATED WITH OTHER FACTORS
(r corrected for unequal range in child's IQ)

Correlated factor	Adopted children			Control children		
	r	P.E.	N	r	P.E.	N
Father's Otis score	.19	.06	178	.51	.04	175
Mother's Otis score	.24	.06	186	.51	.04	191
Mid-parent Otis score	.21	.06	177	.60	.03	173
Father's S.B. vocabulary	.26	.06	177	.47	.04	168
Mother's S.B. vocabulary	.24	.06	185	.49	.04	190
Mid-parent S.B. vocabulary	.29	.06	174	.56	.03	164
Environmental status score	.23	.06	194	.53	.03	194
Cultural index of home	.26	.06	194	.51	.04	194
Child training index	.22	.06	194	.52	.04	194
Economic index	.15	.06	194	.37	.04	194
Sociality index	.13	.06	194	.42	.04	194
Father's education	.19	.06	193	.48	.04	193
Mother's education	.25	.06	192	.50	.04	194
Mid-parent education	.24	.06	193	.54	.03	194
Father's occupational status	.14	.06	194	.45	.04	194

Despite the severity of the correction the absolute change in magnitude of our correlations is not great. The greatest single increase is .05; on the average the

²From Kelly (4, pp. 225, 316).

correlations are increased .038 points. Note that the difference between corresponding coefficients in the Adopted and Control series continues. For the Adopted children they are consistently low, about .20. In the Control group they maintain the level usually found for hereditary physical characteristics, .50. In the case of the latter group heredity and environment are both operative. Hence variance in intelligence is accounted for by variance in heredity and environment combined to the extent of about 25 per cent (square of r .50). In the Adopted group, however, where environment is functioning independently of heredity, variance in intelligence is accounted for by variance in environment only to the extent of about 4 per cent (square of r .20). If we neglect whatever artificial heredity selective placement of adopted children may have introduced into the data, these coefficients are clear evidence of maximum variance in intelligence with variance in environment. Apparently environment cannot compensate for the lack of blood relationship in creating mental resemblance between parent and child. Heredity persists.

A second type of analysis of our data appears in Table 12, where the mean intelligence quotient of Adopted children in each successive occupation level is compared with the intelligence quotient of Control children similarly classified according to occupation of father. Note the constancy of the IQ of Adopted children, irrespective of occupational level. Its progression is insignificant. When variability in IQ within each occupational group is considered the children

in the lowest level almost completely overlap the children in the highest group. The same is true when occupational groups V and I are compared. The difference is entirely effaced between occupational classes III and I. If we ignore the very lowest occupational bracket (VI and VII) in which the number of cases is considerably less than in the other levels, a difference of only one IQ increment exists between the successive occupational classes of Adopted children.

The Control children, on the other hand, advance conspicuously in mean level of intelligence with fathers' occupation. The difference in IQ between the lowest occupational levels and the middle group (III, skilled workmen, clerks, etc.) is as great as the difference in IQ between the lowest and highest occupational group of the Adopted children. Although the children in the two highest occupational classes (business managerial and professional) are undifferentiated they are widely separated from the children of the middle group (about 12 IQ points). The absolute difference in child's IQ between the extreme occupational levels in the Control group is three times as great as the difference between the extreme levels of Adopted children. The fact that the children of each occupational group are almost identical in age should be borne in mind. If the children in the highest occupational levels were younger than those in the middle and lowest groups, then their superior rating in IQ might be said to be a function of age. It will also be recalled that each Adopted child was matched with a Control child of the same age and whose father's occupation

was in agreement with that of the adoptive fathers. Hence, cross-comparisons are entirely valid.

The probability of differences in IQ continuing in the same direction with occupational status in the case of similarly chosen populations as those observed here is shown in Table 13. Apparently none of the differ-

TABLE 13
COMPARATIVE ANALYSIS OF THE PROBABILITY OF DIFFERENCES IN IQ OF CHILDREN EXPRESSED BY D/σ_{diff} , CONTINUING IN THE SAME DIRECTION AS IN THE EXPERIMENTAL POPULATIONS CLASSIFIED ACCORDING TO FATHER'S OCCUPATION

Occupational groups	Adopted children				Control children			
	II	III	V	VI & VII	II	III	V	VI & VII
I	.40	.72	1.27	1.45	.32	3.96	6.45	5.43
II		.36	.88	1.15		3.29	5.44	4.66
III			.41	.80			2.03	1.52
V				.49				.34

ences for the Adopteds are reliable. Reversal of direction might occur in another population; while in the Control population the differences between the two highest groups and every other group are clear and dependable. The probability of a difference in the same direction between the middle and the lowest level is greater for the Controls than the probability of the recurrence of any single difference in the Adopted population. Clearly, environment as typified by occupational status does not compensate for the absence of blood relationship between parent and child.

The foregoing observations take on added significance when the environmental status scores of the successive occupational levels are studied. We note that

in both populations environmental status score increases with occupation and further that the magnitude of each successive difference is more than 2.6 times its standard error (Table 14). It should also be noted

TABLE 14
COMPARATIVE ANALYSIS OF THE PROBABILITY OF DIFFERENCES IN ENVIRONMENTAL STATUS SCORES EXPRESSED BY $D/\sigma_{diff.}$
CONTINUING IN THE SAME DIRECTION AS IN THE EXPERIMENTAL HOMES CLASSIFIED ACCORDING TO FATHER'S OCCUPATION

Occupational groups	Adoptive homes				II	Control homes			
	II	III	V	VI & VII		III	V	VI & VII	
I	3.02	9.12	16.40	16.70	2.96	9.19	14.32	19.43	
II		4.53	9.74	11.02		6.65	11.37	16.41	
III			5.63	7.40			3.33	7.65	
V				2.61				4.79	

that at all levels the mean score of the Adoptive homes is higher than that of Control homes. If intelligence progresses with environment independently of heredity then as great increases in IQ should be expected in the Adopted group as in the Control group.

Considering test intelligence and vocabulary scores of parents, measures which may be more reflective of innate capacity than environmental status score, the same tendency of progression with occupation is noted for both Adoptive and Control parents. (Table 15). In the case of Control parents the occupational levels appear about equally spaced in respect to test intelligence and vocabulary scores. In the Adoptives the two lowest levels are undifferentiated in score as are also the two highest. Yet both extremes are equally spaced from the middle occupational group and at a greater distance than the Controls. If the dynamic

quality of the environment is in proportion to the intellectual level of the parents, then one would conclude that the Adoptive and Control homes are similar in stimulation potential. The difference, however, in intelligence of Adoptive children is only 1 IQ point in either direction, while the difference for the Control children is 5.8 points between occupational groups III and V and 10.7 points between groups III and II. The failure of Adopted children to attain levels of intelligence corresponding more exactly to those of the Control group would appear to be due to a factor or factors other than environment.

When the most stimulating environment was arbitrarily defined to exist in those homes that possessed all of the environmental traits at a level beyond 1 SD

TABLE 15
COMPARATIVE ANALYSIS OF ADOPTIVE AND CONTROL MID-PARENT
SCORES ON THE OTIS TEST OF MENTAL ABILITY AND THE
S.B. VOCABULARY TEST, CLASSIFIED ACCORDING
TO OCCUPATIONAL STATUS

Occupational group	Adoptive parents				Control parents			
	Otis Test		S.B. Vocnb.		Otis Test		S.B. Vocab.	
	M	S.D.	M	S.D.	M	S.D.	M	S.D.
I	59.6	8.0	74.0	6.4	64.6	5.4	74.9	7.8
II	59.6	6.7	73.4	7.2	57.1	10.0	67.8	8.3
III	49.6	11.9	64.6	11.4	51.8	11.5	62.0	9.3
IV								
V	39.7	12.3	59.1	11.6	44.0	11.5	55.7	9.6
VI & VII	38.4	11.2	54.5	9.2	38.3	9.0	48.7	9.1

of the mean of the entire group, very interesting contrasts in mean IQ of the children of these homes appear. The seven Adopted children found in such homes had a mean IQ of 113.3 ± 6.0 . The eight Controls who were so located had a mean IQ of 127.5 ± 9.5 .

These Controls are 17.8 IQ increments above the mean (109.7) of their entire group; the Adopteds so classified are only 2.8 I.Q. points in advance of their mean (110.5). Despite the small number of cases involved, the ratio of the difference in IQ of these selected children to its standard error is 3.52. When the definition is reversed for the least stimulating environment, i.e., the homes located below minus 1 SD for every trait, no cases were found.

If we widen our definition of a stimulating environment so as to include the homes that were at the mean and above for every trait, 58 Adopted and 52 Control children are found. Here again the Control children surpass the Adopteds. The mean for the Controls is 119.4 ± 14.9 , for the Adopteds 112.3 ± 10.8 . The ratio of the mean difference to its standard error is 2.8. Hence, irrespective of attempts to equalize environments, the Controls from the upper levels are distinctly superior in intelligence to the Adopted children at the same levels.

When the children in the least stimulating environment (defining the latter to include the homes that score below the mean on every trait) are considered as a group the Adopteds secure a mean IQ of 106.0 ± 10.2 , the Controls 99.5 ± 10.9 . Although the numbers involved in this analysis are relatively small, 11 Adopteds and 16 Controls and the ratio of the mean difference to its standard error is only 1.5, the results are consistent with the comparisons made on the basis of occupation. Whether the impact of a poor environment is responsible for the lowered IQ is, of course, problema-

tic. Note that the Adopteds fall 4.5 IQ points below the mean of their entire group, while the Controls drop 10.2 points below the mean of their group. If environment is dominant one would expect the same amount of depression in IQ for both groups. It should also be noted that the difference between Control children of the upper and lower environmental levels as defined above is 19.9 IQ points. The difference in the case of the Adopteds is 6.3.

What is the explanation of the difference in IQ with variation in environment in these two sets of children? The marked similarity of the children in age, school grade, and mean IQ will be recalled. Similarity in other respects, also, exists. Vocabulary and IQ correlate .64 for Adopteds; .63 for Controls; Woodworth-Mathew scores of emotional stability and IQ correlate .02 for Adopteds, .06 for Controls. To what extent our results may be due to personality factors of which we have no measure it is impossible to say. We have no reason to believe that such attributes as self-confidence, industry, "drive" or their converse are differently distributed in the two groups of children. Nor have we any reason to believe that the emotional environment provided by the parents of the Control children is more stimulating than that provided by Adoptive parents. To the extent that coefficients of assortative mating (Table 16) are an index to qualitative factors in the home influencing the child's response to his environment there are no differences in our two sets of homes.

If selective placement is entirely absent in the Adopted population, variation in environment may be

TABLE 16
COEFFICIENTS FOR ASSORTATIVE MATING

	Adoptive parents			Control parents		
	r	P.E.	N	r	P.E.	N
Height	.26	.05	178	.27	.05	146
Education	.59	.03	192	.71	.02	193
Father's occupation and mother's education	.58	.03	192	.64	.03	194
Otis score	.57	.03	177	.41	.04	173
Vocabulary	.61	.03	174	.43	.04	164

said to be accountable for changes in IQ to the magnitude of about plus or minus 3 to 5 points. If, as previously stated, adoptive parents in the higher occupational, educational, and social levels secure children of greater promise than the adoptive parents in the lower levels, then the observed differences are clearly a function of genetic diversity rather than a function of environmental variation. Evidence relative to selective placement will be presented in the following section.

VII

VALIDITY OF RESULTS

The confidence that can be placed in our results is dependent on: (1) the freedom of the data from constant errors of selection, (2) the soundness of our method, (3) the support available in supplementary evidence, (4) the absence of selective placement.

SELECTION

Inferences as to the existence of constant errors of selection may be made if on the analysis of the homes that refused to cooperate the presence of characteristics which would have definitely changed our results are discovered. Lower correlations between child's intelligence and environmental attributes would have been found if the refusals were for the most part from homes in which the child's mentality was widely separated from the cultural level of the home and conversely, higher correlations would result if the refusals were from homes in which the child's ability was in close agreement to the cultural level of the home. We have no reason to believe that either of these conditions prevailed. Information as to the school grade of 34 of the 37 refusals showed 29 at grade for age, 3 accelerated and 2 retarded. Further, judging from the occupational classification of the adoptive fathers, the children were fairly evenly distributed in all levels. In occupational group I the number of refusals was 6, 10 in II, 10 in III, 10 in V, 1 in VI and VII. Only 3 adoptive parents stated that they were unwilling to have

their child given a mental examination, and 2 of these parents declared their opposition to be a matter of religious conviction. Irrespective of the genesis of their excuse, the total number refusing on the basis of antipathy to a mental test is insignificant. Fear that the knowledge of adoption would reach the child and the fact that the child was sensitive about being adopted were the two most frequently given explanations for refusing cooperation. We have no evidence that either are related to the intelligence of the child or the cultural level of the home. Emotional upsets because of adoption seem probable when the age of the children in homes refusing cooperation is considered. On the average the children of these homes were one and a half years older (age 10.9 ± 2.4) than the experimental children. In general, there seems little evidence that the coefficients of resemblance between adoptive parents and children were affected by our refusals.

Although, as will be recalled, the application of Pearson's formula corrected our curtailed variability and made the coefficients of resemblance for the Adopted children exactly comparable with those for the Control children, we are still confronted with the question of whether the variability in the entire universe (dependent adopted children) would be greater or less than that observed. Is our experimental population typical of the intellectual ability of adopted children? Is there anything in the data that would force the average level below or above that of dependent children in general? Comparing family backgrounds (Tables 17 and 18) from evidence of occupa-

TABLE 17
COMPARATIVE ANALYSIS OF THE OCCUPATIONAL DISTRIBUTION OF
TRUE PARENTS OF ADOPTED CHILDREN

Occupational group	True fathers		Males in gen'l Pop. age 20-24 N—4, 121, 914	True mothers	
	General group* N—1323	Experimental group N—89		General group* N—1308	Experimental group N—89
I	2.1	1.1	1.7	0.4	0.0
II	4.5	2.2	2.4	4.0	9.0
III	18.1	27.0	14.1	8.7	15.7
IV	9.0	12.4	9.8		
V	35.8	23.6	32.0	25.8	31.5
VI & VII	30.5	33.7	40.0	61.1	43.8

*From Leahy (6, pp. 314, 324).

TABLE 18
COMPARATIVE ANALYSIS OF THE EDUCATIONAL ATTAINMENT OF
TRUE MOTHERS OF ADOPTED CHILDREN

School attainment	General group N—1218*	True mothers	
		Experimental group N—96	
Completed high school or more	16.1	21.9	
High school not completed	26.9	23.9	
Less than high school	56.9	54.1	

*From Leahy (6, pp. 307).

tion and education of parents with that of a larger sample of parents whose children were adopted leads one to the conclusion that the congenital level of the offspring of parents represented in our study would be similar to that of all adopted illegitimate children. It is possible that the true fathers and mothers whose occupation and education are unknown would either raise or depress the level of the group. However, the mean IQ of the children whose true father's occupation is known is 110.9, only .4 in advance of the mean of the entire experimental population. When the group

for whom either true parent's education or occupation is known are regarded separately, the mean IQ of the children is 110.8 ± 12.5 . Foundlings and children for whom the social agency had no family history, comprising a group of 48, have a mean IQ of 109.9 ± 12.3 . Hence, we may infer a similarity in occupational and educational level for the parents for whom we have no history.

The distortion of average IQ of adopted illegitimate children is most probably due to the fact of selected heredity. Illegitimate children who are not relinquished for adoption have in contrast an inferior social background (Leahy, 6). Further, as previously stated, laws which have been in force since 1925 in Minnesota do not permit the adoption of infants of parents known to be feebleminded. Since 1918, a trial period of six months' residence in the new home before legal adoption has been mandatory. Such policies doubtless raise the average level and reduce the range of intelligence of children who are placed in adoptive homes. It seems fair to conclude that our experimental children are no more or less variable in intelligence than adopted illegitimate children in general. The fact of innate positive skewness in intelligence should not prevent or diminish the operation of the influence of environment on intelligence. If environment is prepotent we should find significant variability in intelligence with variability in environment.

METHOD

Only insofar as our method can be demonstrated to

have avoided ambiguities, to have insured accuracy, and to have provided a check upon the reliability of our measures may we have confidence in our results. The first of these was fulfilled by the criteria held for experimental subjects. You will recall that every precaution was taken to escape ambiguities arising from selective mental resemblance between adoptive parent and child. Age at placement, race, and nationality extraction were rigidly controlled.

In order to insure accuracy uniform procedures were adhered to in gathering the social data, in the administration of tests, in scoring tests, and in analyzing the data. As previously reported two experienced examiners whose training and experience were practically identical administered all of the children's tests. All tests were rescored. All classifications and statistical computations of a major nature were done on the Hollerith Sorting and Tabulating Machine. Computations involving the use of calculating machines were systematically checked. A check upon the reliability of our measures, as well as on the whole experimental procedure, was provided by the Control group. Since these children agreed exactly in number, age, and sex with the experimental subjects, we have reason to believe that our tests and measures reflect the true ability of both groups with equal accuracy. The extent to which Control homes were truly a control is attested by the marked agreement of the two sets of homes (adopted and control) for each environmental attribute that we attempted to measure. Hence, we may conclude that the results from the Adoptive and Control groups furnish a valid comparison.

SUPPLEMENTARY DATA

If environment is dominant we should expect that unrelated children in the same household would agree markedly in ability. The contrary was found as may be seen by the following:

	<i>r</i>	PE	N
IQ of Exper. Adopteds and Own Children	.06	.14	25
IQ of Unrelated Adopteds in Same Household	.12	.22	10
Vocab. of Exper. Adopteds and Own Children	.06	.13	25

Although the number of cases is small the results suggest that the children are widely different in intellectual ability, regardless of their common environment.

In 20 cases of own children of Adoptive parents, IQ of own child and mid-parent Otis correlated .36. This correlation follows the expected familial pattern.

Although our single measure of the emotional stability of the children is probably not sufficiently reliable to permit any conclusions about personality differences, the similarity in the relationship between Woodworth-Mathews' scores and home environment for both groups of children is striking. As indicated below, Woodworth-Mathews' scores correlate:

- .10 for Adopteds, .13 for Controls with mid-parent Otis Score
- .04 for Adopteds, .07 for Controls with mid-parent Vocabulary
- .06 for Adopteds, .13 for Controls with Cultural index of home

.11 for Adopteds, .18 for Controls with Child Training Index of home
 —.04 for Adopteds, .07 for Controls with Occupation of father.

Clearly the fact of either blood relationship to persons shaping the environment or its absence makes no difference. Adopted children, where presumably only environment is operative, behave in a manner similar to own children where both heredity and environment are operative. These results are in distinct contrast to our observations on the relationship of intelligence to home environment. They are based on the tests of 72 Adopteds and 77 Controls and give support to the theory that heredity plays a less significant role than environment in the variation observed for traits other than intelligence

TABLE 19
 WOODWORTH-MATHEWS SCORES ACCORDING TO OCCUPATIONAL STATUS

Occupation of father	N	Adopted children		N	Control children	
		M	S.D.		M	S.D.
I	16	59.3	6.8	11	63.1	4.0
II	9	54.8	9.7	14	61.1	6.0
III	17	59.7	7.5	19	61.1	5.2
IV	—	—	—	—	—	—
V	23	58.8	7.9	25	62.5	5.7
VI & VII	7	60.4	6.7	8	59.3	8.6

Table 19 demonstrates the similarity in performance on the Woodworth-Mathews when the children are classified according to the occupation of their fathers. The cross differences are slight; none are significant. Further, it should be noted that there is no significant progression in score with occupational status in either

group. This is directly contrary to our observations for test intelligence of children and occupational status of father. As may be seen by referring to Table 12, although Adopted children did not progress significantly in IQ with occupational status, the Control children made significantly large gains in IQ when comparisons were made between the two lowest and middle occupational groups and when the latter was contrasted with the two highest levels.

SELECTIVE PLACEMENT

The extent to which our results are free from selective placement of children on the basis of cultural similarity between adoptive and true parents determines the limits of the influence of environment on intelligence. If selective placement is entirely absent, then our results stand as evidence of the maximum influence of environment. If selective placement exists then our results overstate the influence of environment on intelligence.

In Table 20 the relationships of cultural background of true and adoptive parents are shown. All of the coefficients are low. Only three are reliable. The majority, however, are positive. In general, they offer weak evidence for selective placement in our data. Nevertheless, further analysis was applied for an appraisal of the point.

One check involved an analysis of the replies of 22 placement workers to a questionnaire which asked the importance of certain attributes in judging the fitness of a child for a home. Most of the workers who an-

TABLE 20
FACTORS IN ADOPTIVE HOME CORRELATED WITH FACTORS IN THE
BACKGROUND OF CHILD AS REPORTED BY SOCIAL AGENCY

	True father's occupation			True mother's occupation			True mother's education		
	r	P.E.	N	r	P.E.	N	r	P.E.	N
Adoptive father's occupation	.09	.07	89	.20	.07	89	.23	.06	96
Adoptive father's education	.24	.07	88	.21	.07	88	.20	.07	95
Adoptive mother's education	.10	.07	88	.38	.06	88	.25	.07	94
Adoptive mid-parent Otis score	.11	.07	79	.12	.07	83	.20	.07	89
Adoptive mid-parent vocabulary test	-.02	.08	76	.07	.07	79	.08	.07	86
Social status of adoptive home	.20	.07	89	.29	.06	89	.23	.06	96

swered the questionnaire had been engaged in child placing in Minnesota during the period from which our cases were drawn. Eighteen of the 22 regarded *probable intelligence of child* as of very great importance. The group, however, was evenly divided on the significance of education and occupation of true parents in judging *probable intelligence of child*. Eleven regarded education of true mother of slight or moderate importance and 11 held it to be of great or very great importance. The ratings for education of true father followed the same pattern. The judgments on the significance of occupation of true parents were similarly divided. Obviously if these placement workers behave in accordance with their replies the possibility of selective placement in a group of adopted children on the basis of education and occupation of true parents is nil.

The second check consisted in holding background constant in the correlation between child's IQ and adoptive home. This, clearly, is the crucial test. Time

permitted the analysis for only a limited number of traits of the adoptive home. The traits selected, however, and presented in Table 21, are the most generally

TABLE 21
COMPARATIVE CORRELATIONS BETWEEN CHILD'S IQ AND ADOPTIVE HOME

	Background factor held constant		Zero order r background not constant	Entire group
	True father's occupation N=89	True mother's occupation N=89	True mother's education N=96	
Adoptive father's occupation	.18	.03	.05	.12
Adoptive father's education	.12	.13	-.02	.16
Adoptive mother's education	.19	.16	.13	.21
Adoptive mid-parent Otis score	.26	.10	.09	.18
Adoptive home environment score	.19	.16	.02	.19

used indices of environment; namely, occupation, education, test intelligence of parents, and home rating.

An examination of this table shows that the correlations between child's IQ and attributes in the adoptive home are not greatly different from those for the entire group except when true mother's education is held constant. Then the correlations drop for each correlated factor. What may we infer? Clearly, for the populations involved, true mother's education appears to be a basis of selective resemblance between the adoptive home and its child, while true parent's occupation does not. Whether the population for whom no background history is available would support or refute these findings is problematic. Certainly the correlations reported in Table 11 may be regarded as no understatement of the relationship between

child's IQ and home environment. From evidence of family background reported by adoptive parents on 50 of our cases, mental resemblance due to selective cultural likeness seems highly probable and therefore our correlations for child's IQ and environment tend to overstate the influence of nurture. Because of the possibility of retrospective falsification in reports of this kind, these data may be ignored and the correlation of .20 be regarded as a general characterization of the relationship of child's IQ and environment.

VIII

CONCLUSIONS

By methods which allowed the effects of environment to be studied separately from those of heredity in combination with environment, this study attempted to discover the influence of environment and heredity on intellectual variation. As stated in the opening section, the tendencies observed in this study are valid only for populations which are similar to the experimental population in composition. However, the consistency with which a coefficient of .50 was secured for parent and offspring suggests that the restricted range in both the hereditary and environmental variables was reciprocal and hence no serious distortion in our results exists. The main conclusions are as follows:

1. Variation in IQ is accounted for by variation in home environment to the extent of not more than 4 per cent; 96 per cent of the variation is accounted for by other factors.
2. Measurable environment does not shift the IQ by more than 3 to 5 points above or below the value it would have had under normal environmental conditions.
3. The nature or hereditary component in intelligence causes greater variation than does environment. When nature and nurture are operative, shifts in IQ as great as 20 IQ points are observed with shifts in the cultural level of the home and neighborhood.

4. Variation in the personality traits measured in this study other than that of intelligence appears to be accounted for less by variation in heredity than by variation in environment.

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LA NATURE—LE MILIEU ET L'INTELLIGENCE

(Résumé)

Au moyen d'une comparaison d'un groupe d'enfants adoptés avec de vrais enfants vivant dans un milieu approximativement pareil, qui a permis que les effets du milieu soient étudiés séparément de ceux de l'hérédité en combinaison avec le milieu, cette étude a essayé de découvrir l'influence du milieu et de l'hérédité sur la variation intellectuelle. Les tendances observées dans cette étude sont de valeur seulement pour les populations qui sont d'une composition pareille à celle de la population expérimentale. Cependant, la constance avec laquelle on a obtenu un coefficient de 0,50 pour le parent et l'enfant suggère que la variation restreinte dans les variables héréditaires et celles du milieu a été réciproque et il n'existe ainsi nulle distorsion sérieuse dans nos résultats. Les conclusions principales sont les suivantes:

1. La variation dans le QI est expliquée par la variation dans le milieu de la maison de non plus de quatre pour cent; 96 pour cent de la variation est expliqué par d'autres facteurs.

2. Le milieu mesurable ne change le QI que de 3 à 4 points au-dessus ou au-dessous de la valeur qu'il aurait eue dans les conditions normales du milieu.

3. La composante de nature ou héréditaire dans l'intelligence cause une plus grande variation que celle causée par le milieu. Quand la nature et le milieu sont opératifs, des changements du QI aussi grands que 20 points du QI sont observés avec des changements dans le niveau de culture de la maison et du voisinage.

4. La variation dans les traits de personnalité mesurés dans cette étude autres que celle de l'intelligence semble être expliquée moins par la variation dans l'hérédité que par la variation dans le milieu.

LEAHY.

VERERBUNG, UMGEBUNG UND INTELLIGENZ

(Referat)

Durch einen Vergleich einer Gruppe von adoptierten Kindern mit anderen Kindern in ungefähr derselben Umgebung, der die Untersuchung der Wirkungen der Umgebung gesondert von denjenigen der Vererbung in Verbindung mit der Umgebung ermöglichte, wurde in dieser Untersuchung der Versuch gemacht, den Einfluss der Umgebung und Vererbung auf intellektuelle Abweichung aufzudecken. Die Ergebnisse dieser Untersuchung sind gültig nur für Gruppen, welche der experimentellen Gruppe ähnlich sind. Die Gleichförmigkeit aber, mit der ein Koeffizient von 0,50 für Eltern und Nachkommenschaft erhalten wurde, weist darauf hin, dass der beschränkte Umfang bei den Umgebungs- und Vererbungsvariablen wechselseitig waren und folglich keine Verstellung unserer Ergebnisse aufweisen. Die Hauptschlüsse sind folgende:

1. Eine Variation des IQ wird durch die Variation der Heimumgebung bis zum Umfang von mehr als 4 Prozent erklärt; 96 Prozent der Variation wird durch andere Faktoren erklärt.

2. Die messbare Umgebung verändert den IQ nicht mehr als 3 bis 5 Punkte über oder unter dem Wert, den er sonst unter normalen Umgebungsumständen haben würde.

3. Die Natur- oder Vererbungskomponente bei der Intelligenz verursacht eine grössere Variation als die Umgebung. Wenn Vererbung und Umgebung tätig sind, werden Verschiebungen des IQ so gross wie 20 IQ-Punkte mit Verschiebungen der Kulturschichten des Heims und der Nachbarschaft beobachtet.

4. Die Variation des Persönlichkeitszuges nasser der Intelligenz, der in dieser Untersuchung gemessen wurde, scheint weniger durch die Variation der Vererbung als durch die Variation der Umgebung erklärt zu werden.

LEAHY.