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## A Study of the Effects of Differential Stimulation on Mentally Retarded Children\*†

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The study of the nature of intelligence challenges the interest of psychologists and educators not only because of the theoretical concepts involved but also because of the implications relating to child care and education. If, on the one hand, intelligence is static, a fixed entity, and relatively unmodifiable by changes in environmental impact, then changes in living conditions and amount and kind of education can be expected to have little influence on the mental level of individuals.

On the other hand, if intelligence shows change in relation to shifts in environmental influence, then our concept must include modifiability, and the implications for child welfare become more challenging.

This latter concept was postulated by Alfred Binet. In his significant book entitled, *Les Idees Modernes Sur Les Enfants* (1), published in 1909, Binet devotes an enlightening chapter to the topic, **Intelligence: Its Measurement and Education**. He is surprised and concerned at the prejudice against the concept of modifiability of intelligence.

To quote: "Some recent philosophers appear to have given their moral support to the deplorable verdict that the intelligence of an individual is a fixed quantity, a quantity which cannot be augmented.

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We must protest and act against this brutal pessimism. We shall endeavor to show that it has no foundation whatsoever." (pp. 54-55)

Binet goes on to cite observations and situations relating to the teaching of subnormal children, summarizing as follows: "A child's mind is like a field for which an expert farmer has advised a change in the method of cultivating, with the result that in place of desert land, we now have a harvest. It is in this particular sense, the only one which is significant, that we say that the intelligence of children may be increased. One increases that which constitutes the intelligence of a school child; namely, the capacity to learn, to improve with instruction." (p. 55)

#### STATEMENT OF THE PROBLEM

The purpose of this study was to determine the effects on mental growth of a radical shift in institutional environment to one providing superior stimulation, introduced into the lives of mentally retarded children of early preschool ages. These children were placed singly or in some cases by twos on wards of brighter girls in an institution for feeble-minded children. Preliminary observation had given some indication that such an environment was mentally stimulating for children two to three years of age. As a correlary aim, it seemed pertinent to study a contrast group of dull-normal and normal children of somewhat similar ages residing over a period of time in a relatively nonstimulating orphanage environment.

#### ORIGIN OF THE STUDY

This research project was the outgrowth of a clinical surprise. Two children under a year and a half, in residence at the state orphanage, gave unmistakable evidence of marked mental retardation. Kuhlmann-Binet intelligence tests were given both children. C. D.,<sup>1</sup> thirteen months of age at time of examination, obtained an IQ of 46, and B. D.,<sup>2</sup> at sixteen months, scored an IQ of 35. Qualitative observations of the examiner substantiated a classification of imbecile level of mental retardation. In the case of B. D., the examiner felt that the child's actual level was perhaps slightly higher, but not to exceed ten points or an IQ level of 45. As check tests for further corroboration, the Iowa Tests for Young Children (2) were used. Mental ages of approximately six and seven months respectively were obtained.

Obviously a classification of feeble-mindedness would not be justified if based on results of intelligence tests alone, particularly at these young ages. However, behavioral reactions in conjunction with the examinations of the pediatrician, and observations by the superintendent of nurses relative to activity or lack of activity of these children in the nursery in contrast with other children gave ample substantiation for a classification of marked mental retardation. C. D., at thirteen months, was making no attempts to stand, even with assistance. She could not pull herself to an upright position with the aid

<sup>1</sup>Designated as case 5 in Table 1, page 14.

<sup>2</sup>Designated as case 8 in Table 1, page 14.



of crib or chair, nor did she display much manipulative activity with blocks or play materials. Spontaneous vocalization also was lacking. B. D., at sixteen months, was not vocalizing, was unable to walk with help, and made relatively no responses to play materials in the nursery.

There were no indications of physiological or organic defects. Birth histories were negative, both children being full term normal delivery with no indications of birth injury or glandular dysfunction. Social histories were not flattering. Both children were illegitimate. In the case of C. D., the mother had been adjudged feeble-minded and a legal guardian was appointed. Although the mother claimed to have finished the eighth grade at sixteen years, the social workers felt that she was very retarded and probably had had a difficult time in school. A Stanford-Binet (1916 revision) intelligence test given at the University Hospital showed a mental age of nine years and an IQ of 56. She had always been healthy. Her father was a miner, had been unable to learn in school, and had deserted his family. Little is known of the father of the child, although it was reported that he had gone to high school.

B. D.'s mother was an inmate in a state hospital, diagnosed as psychosis with mental deficiency. She was slow to sit up, walk, and talk, and went only to the second grade in school. The maternal grandfather drank to excess and his brother died in a state hospital of general paralysis of the insane. One maternal great aunt died of epilepsy. B. D.'s father is unknown; the mother named an inebriate formerly released from the state hospital.

Accordingly, these two children were recommended for transfer to the school for feeble-minded.\* We quote from the recommendations for transfer as follows: C. D.: "Diagnosis of mental ability: Mental deficiency of imbecile level, which will probably continue with an increase in age. Prognosis: Poor. With this deficiency in mental development, C. D. will be unable to make her way outside the care and protection offered by an institution for feeble-minded children. Her relatives are not in a position to give her the continuous care she will need." Diagnosis and prognosis on B. D. were similar to the one just quoted.

Following this recommendation, the children were committed to the school for feeble-minded. They were placed on a ward of older girls, ranging in age from eighteen to fifty years and in mental age from five to nine years.

Six months after transfer, the psychologist visiting the wards of the institution was surprised to notice the apparently remarkable development of these children. Accordingly they were re-examined

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\*These two children were transferred to the state school at Woodward. All other children in the experimental group were sent to the state school at Glenwood.

on the Kuhlmann-Binet, C. D. obtaining an IQ of 77 and B. D. an IQ of 87. Twelve months later they were tested again with IQ's of 100 and 88, respectively. Tests were again given when the children were forty months and forty-three months of age respectively, with IQ's of 95 and 93.

In the meantime, inquiries were made as to reasons for this unusual development. Their "home" or ward environment was studied. It was observed that the attendants on the ward had taken a great fancy to the "babies." They were essentially the only preschool children on the ward, other than a few hopeless bed patients with physiological defects. The attendants would take these two children with them on their days off, giving them car rides and taking them down town to the store. Toys, picture books, and play materials were purchased by these admiring adults. The older, brighter girls on the wards were also very much attached to the children and would play with them during most of the waking hours. Thus it can be seen that this environment turned out to be stimulating to these preschool children of low initial mental level.

Following these last examinations, it was felt that the stimulation value of this particular kind of an environment had been pretty well exhausted. If the resulting level of intelligence were to be maintained, a shift to a more normal environment seemed essential. Furthermore, since the children were then well within the range of normal intelligence, there ceased to be any justification for keeping them in an institution for the feeble-minded. Accordingly, they were transferred back to the orphanage and from there placed in rather average adoptive homes, their ages then being three years, six months, and three years, eight months. After approximately fifteen months in the foster homes, the children were again examined, this time using the Stanford-Binet. IQ's of 94 and 93 were obtained. From the evidence obtained, there is every indication that they will continue to classify as normal individuals as they increase in age. Accordingly, legal adoption has been completed in both cases.

From these startling preliminary findings, several questions were presented. Observations of similarly retarded children comparable in ages, remaining in an orphanage nursery, showed continued lack of mental development. In such a situation, the retarded child with numbers of other children of higher intelligence but of the same age seemed to make no gain in rate of mental growth. Also, since there was a ratio of only one or two adults to twelve or eighteen children, adult contacts were at a minimum and limited largely to physical care. Obviously, the retarded child could not be placed directly in an adoptive home as there could be no marked assurance that later development would be normal. Boarding home care to permit further evaluation and observation of development would, of course, be a logical solution of such a problem. However, the code of Iowa pro-



vides only for institutional care or placement in free or adoptive homes. Consequently, there seemed to be only one alternative, and that a rather fantastic one; namely, to transfer mentally retarded children in the orphanage nursery, one to two years of age, to an institution for feeble-minded in order to make them normal. In view of the earlier preliminary findings, it was hoped that possibly 50 per cent of the cases might show at least some improvement. With cases not showing improvement, the transfer would be proper, and they could remain in that environment permanently. The suggestion was presented to the Board of Control, and although received with doubts and misgivings, was approved. It was decided that children so transferred would not be technically committed to the institution for feeble-minded, but would rather be guests in residence at the school for feeble-minded and would continue to appear on the orphanage population list. In other words, they would simply be temporarily hospitalized for therapeutic treatment. In this way there would not be the stigma of commitment to the school for feeble-minded appearing on the case histories. Each case was to be evaluated from time to time. If and when improvement failed to ensue, final commitment was to be consummated.

## SUBJECTS

### Experimental Group

Accordingly, from time to time, retarded children from the Iowa Soldiers' Orphans' Home at Davenport were sent to the Iowa Institution for Feeble-Minded Children at Glenwood. The experimental group includes all children so transferred who were under three years of age at time of transfer, a total of thirteen. The following tabulation shows sex, chronological age at time of examination before transfer, Kuhlmann-Binet mental age, and IQ; and chronological age at time of transfer.

#### Examination Prior to Transfer

Case	Sex	Chronological Age, Months	Mental Age, Months	IQ	Chronological Age, Months at Transfer
1	M	7.0	6.0	89	7.1
2	F	12.7	7.2	57	13.1
3	F	12.7	10.8	85	13.3
4	F	14.7	10.8	73	15.0
5	F	13.4	6.0	46	15.2
6	F	15.5	12.0	77	15.6
7	F	16.6	10.8	65	17.1
8	F	16.6	6.0	35	18.4
9	F	21.8	13.2	61	22.0
10	M	23.3	16.8	72	23.4
11	M	25.7	19.2	75	27.4
12	F	27.9	18.0	65	28.4
13	F	30.0	10.8	36	35.9

The mean chronological age at time of transfer was 19.4 months, median 17.1 months, with a range from 7.1 to 35.9 months. Range of IQ's was from 35 to 89 with a mean of 64.3 and a median of 65.0. In eleven of the thirteen cases, additional tests had been given shortly before or in conjunction with the tests reported above. These were either repeated Kuhlmann-Binet examinations or Iowa Tests for Young Children. Such tests gave further corroboration of classifications of marked mental retardation.

That such retardation was real and observable was substantiated by the reports of the pediatrician and the nurse in charge, indicating lack of development.<sup>3</sup> The orphanage policy is to place children and infants in adoptive homes as soon as possible. All children in this group were considered unsuitable for adoption because of mental retardation. In Case 1, although the IQ was 89, it was felt that actual retardation was much greater. At seven months this child could scarcely hold his head up without support. There was little general bodily activity as compared with other infants the same age. In Case 3, at twelve months there was very little activity and sitting up without support was very unsteady. She could not pull herself to a standing position and did not creep. Case 11 was not only retarded, but showed perseverative patterns of behavior, particularly rocking back and forth incessantly. Cases 5, 8, and 13 were classified at the imbecile level. Descriptions of Cases 5 and 8 have been given under the origin of the study. Case 13, the oldest child in the group, showed perhaps the greatest amount of retardation. She was committed to the orphanage at twenty-eight months of age and came from a home where extreme neglect was typical. At thirty months of age, she was unable to stand alone, could not walk with help, and required support when sitting in a chair.

Following transfer to the school for feeble-minded, examinations by the superintendent and other members of the medical staff further corroborated the reports from the orphanage as to the marked degree of mental retardation.

#### **Contrast Group**

This group did not exist as a designated group until the close of the experimental period. These children were simply examined as individuals from time to time along with the other children in the orphanage as routine procedure. It was only after the data on the experimental group had been analyzed that the decision was made to study a group of children remaining in the orphanage for contrast

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<sup>3</sup>The writers are indebted to Dr. M. D. Ott, pediatrician, and Miss Sadie LeFevre, superintendent of nurses, Iowa Soldiers' Orphans' Home, for these observations and reports.



purposes. Children were included who (a) had had initial intelligence tests under two years of age, (b) were still in residence in the orphanage at approximately four years of age, and (c) were in the control group of the orphanage preschool study (5), or (d) had not attended preschool. The study of the orphanage preschool referred to included two groups of children matched in chronological age, mental age, IQ, and length of residence in the institution. The one group had the advantages of the more stimulating environment of preschool attendance while the control group experienced the less stimulating environment of cottage life. Since the purpose of the contrast group for the present study was to include children in a relatively non-stimulating environment, children who had attended preschool could not be included. Such limitations, however, did not constitute a selective factor as far as the make-up of the children was concerned. A total of twelve children met these requirements and have been designated as the contrast group in the present study.

The following tabulation shows sex, chronological age at time of first examination, Kuhlmann-Binet mental age, and IQ:

Case	Sex	Chronological Age, Months	Mental Age, Months	IQ
14	F	11.9	11.0	91
15	F	13.0	12.0	92
16	F	13.6	9.6	71
17	M	13.8	13.2	96
18	M	14.5	14.4	99
19	M	15.2	13.2	87
20	M	17.3	14.0	81
21	M	17.5	18.0	103
22	M	18.3	18.0	98
23	F	20.2	18.0	89
24	M	21.5	10.6	50
25	M	21.8	18.0	83

The mean chronological age at time of first examination was 16.6 months with a median at 16.3 months. The range was from 11.9 months to 21.8 months. The mean IQ for the group was 86.7 (median 90.0). With the exception of two cases (16 and 24) the children had IQ's ranging from 81 to 103.

Reasons for earlier nonplacement in adoptive homes were in general for those other than mental retardation. In fact, nine were, or had, been considered normal as far as mental development was concerned. Five children were withheld from placement simply because of a poor family history. Two were held because of improper commitment, two because of luetic condition, and one because of mental retardation.

### Birth Histories of the Group

In the examination of the birth histories of the two groups, no marked discrepancies were observed. In the experimental group, eight children were full term with normal delivery. Prematurity occurred in three cases (4, 7, and 9). Case 7, two months premature, spent the first two months in an incubator. The other two cases did not require special care. One case, 11, was delivered by cesarean section. The remaining case, 13, was not admitted to the orphanage until twenty-eight months of age. No birth history was available.

The children of the contrast group present similar birth histories. Eight of this group were full term babies with normal labor. One, Case 23, was premature and delivered by breach extraction. Case 17 was delivered by low forceps at full term. As a result of difficult labor, he presented early symptoms of intracranial hemorrhage. There were periods of cyanosis and clonic convulsions, and feedings were taken poorly. At the end of a week, however, the cyanosis had diminished and there were no longer convulsions. By the end of fifteen days, the child appeared normal. Case 24 was admitted at fourteen months with no birth history available.

These data have been presented in summary form in the following tabulation:\*

Information Concerning Birth	Experimental Group	Contrast Group
Birth injuries		1
Pathological labor	2	3
Prematurity	3	1
Normal delivery	8	8
Unknown	1	1

### Medical Histories

In the evaluation of the medical histories of both the experimental and contrast groups, little of significance was found in the relationship between illnesses and the rate of mental growth. In the experimental group, one child, Case 9, had congenital syphilis, but immediate antiluetic treatment following birth was adequate and serology was negative during the experimental period. In the contrast group, two children, Cases 14 and 16, were luetic, but Case 16 responded to early antiluetic treatment and all serology has been negative during the period of the study. However, in Case 14, a question may be raised as to the contributing effects of persistent syphilis. Blood Wassermann and Kahn were negative at nine months of age, but examination at thirty months revealed 4 plus Wassermann and Kahn. Treatment was again instituted, and at forty-six months both blood and spinal fluid serology were negative. Case 16, on admission to the orphanage, had enlarged spleen and liver, a tentative diagnosis of Gaucher's disease being made. This did not seriously affect the activity of the child during the course of study.

\*A given case may appear in more than one category.



Considering all children of both groups, they have had various upper respiratory infections, occasional contagious diseases, mild eczemas, but nothing more severe than the ordinary child of pre-school age would have in the average home.

### Family Backgrounds

Social histories revealed that the children of both experimental and contrast groups came from homes of low social, economic, occupational, and intellectual levels. The family background is comparable to that reported by Skeels and Fillmore (4) in their study of the mental development of children from underprivileged homes and Skodak's study (6) of children in foster homes placed at ages two to five. The backgrounds of the children in the two groups were comparable.

**Mothers.**—Information relating to education was available for eleven of the thirteen mothers in the experimental group and ten of the twelve mothers in the contrast group. The mean grade completed by mothers of children in the experimental group was 7.8 with a median at grade eight. Only two had any high school work, one having completed the eleventh grade and one the tenth grade (Cases 3 and 6). In one case, it was doubtful if the second grade had been completed (Case 8). Two (Cases 1 and 5) had dropped out of the eighth grade at the age of sixteen.

In the contrast group, the mean grade completed was 7.3 with a median at 7.5. One mother (Case 19) had completed high school and one had an equivalent of ninth grade education.

Occupational history of mothers, available on seven of the mothers of the experimental group and nine of the contrast group, included mainly housework, either in the homes of parents or working out as domestics. In only one instance was there a higher level indicated (Case 24 of the contrast group) in which the mother had been a telephone operator and had done general office work.

Intelligence tests<sup>4</sup> had been obtained on five of the mothers in the experimental group and nine of the mothers in the contrast group. The mean IQ for mothers of the experimental group was 70.4, with a median at 66. One additional mother, although not tested, was considered feeble-minded and had gone only as far as the second grade. Four mothers had IQ's below 70, and one classified as normal with an IQ of 100.

Of the nine mothers in the contrast group, only two had IQ's above 70, one being 79 and the other 84. The others ranged from 36 to 66. The mean IQ was 63, with a median at 62.

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<sup>4</sup>Stanford-Binet (1916) intelligence tests. Most of these were given by psychologists either at the Psychopathic Hospital or the University Hospital of the University of Iowa. Maximum chronological age used was sixteen years.

**Fathers.**—Little information was available on the fathers, in fact in many cases paternity was doubtful. Ten of the children in each group were illegitimate. In the experimental group, information relating to education was available on only four fathers. Two had completed the eighth grade, one completed high school and one had gone to high school but how far was not known. Occupational status was indicated on only three of the fathers; one was a traveling salesman, one a printer, and one a farm hand.

In the contrast group, educational information was available on four. One had completed high school and one was considered talented in music (Case 24). Two had completed eighth grade, (Cases 15 and 18), and one the sixth grade (Case 21). Occupational information was known on eight of the fathers. Three were day laborers, two were farm hands, one worked on the railroad section, one was a farmer, and one was in a C.C.C. camp.

A qualitative analysis of social histories seems to justify the conclusion that within these educational and occupational classifications of true parents, the individuals represent the lower levels in such groups. Most of these fathers and mothers dropped out of school because of having reached their limits of achievement, and in no sense of the word represent the averages of their grade placements. The same may be said with reference to occupational status.

#### DESCRIPTION OF THE ENVIRONMENTS

##### **Experimental Group**

Children in this group were transferred from the orphanage nursery to the school for feeble-minded, and placed on the wards with older, brighter girls. Wards in the girls' division were used. This included a large cottage of eight wards with a matron and an assistant matron in charge and one attendant for each ward. There are approximately thirty patients on each ward, including girls ranging in ages from eighteen to fifty years. On two wards, (wards 2 and 3) are girls of the higher levels, mental ages from nine to twelve years. On two other wards (wards 4 and 5) the mental levels are from seven to ten years, and on another ward (ward 7) the mental ages are from five to eight.

With the exception of ward 7, there were few if any younger children on the wards aside from the experimental children. In some cases, there were one or two other young children on the ward, usually a mongol or a spastic paralysis case. In general, one, or at the most two, children in the experimental group were placed on a given ward.

The attendants and the older girls became very fond of the child placed on the ward and took great pride in its achievement. In fact,



there was considerable competition between wards to see which one would have their "baby" walking or talking first. The girls would spend a great deal of time with the children, teaching them to walk, talk, play with toys and play materials, and in the training of habits.

Most of the clothing for these children was made by the older girls. The girls were so fond of the children that they would actually spend their small earnings and allowances to buy them special foods, toys, picture books, and materials for clothing. Similarly attendants gave of their time, money and affection, and during their free hours frequently took the children on excursions, car rides, and trips. In addition, it was the policy of the matron in charge of the girls' school division to single out certain of these children whom she felt were in need of special individualization, and permit these children to spend a portion of time each day visiting her office. This furnished new experiences including being singled out and given special attention and affection, new play materials, additional language stimulation, and contacts with other office callers.

An indication of the interest in these children was shown by the fact that a baby show was held for one of the Fourth of July celebrations. Each ward made a float upon which its "baby" rode, dressed in costume. Prizes were awarded for the winning baby, most attractive costume, and best float.

The spacious living rooms of the wards furnished ample room for indoor play and activity. Whenever weather permitted, the children spent some time each day on the playground, supervised by one or more of the older girls. In this situation, they had contacts with other children of similar ages. Outdoor play equipment included tricycles, swings, slides, sand box, etc.

In addition to the opportunities afforded on the wards, the children attended the school kindergarten. They were sent to school as soon as they could walk. Toddlers remained for only half of the morning, whereas those of four or five years of age were in kindergarten the entire morning. Activities carried on in the kindergarten were more in the nature of a preschool than the more formal type of kindergarten.

As a part of the school program, the children each morning attended fifteen minute chapel exercises, including group singing and music by the orchestra. The children also attended the dances, school programs, moving pictures, and Sunday chapel services.

In considering this enriched environment from a dynamic point of view, it must be pointed out that in the case of almost every child, some one adult, (older girl or attendant) would become particularly attached to a given child and would figuratively "adopt" him. As a consequence there would develop a rather intense adult-child rela-

tionship with the other adult contacts being somewhat more marginal. This meant that such a child had some one person with whom he was identified and who was particularly interested in him and his achievement. It was felt that this constituted an important aspect of the environmental impact on the child.

### **Contrast Group**

The environment of the children in the contrast group is considered to be rather representative of the average orphanage. The outstanding feature is the profound lack of mental stimulation or experiences usually associated with the life of a young child in the ordinary home.

Up to the age of two years, the children were in the nursery of the hospital. This was limited to a rather small play room with additional dormitory rooms of two to five beds each. The children were cared for by two nurses with some additional assistance by one or two girls of ten to fifteen years of age. The children had good physical and medical care, but little can be said beyond this. Contacts with adults were largely limited to feeding, bathing, dressing, and toilet details. It can readily be seen that with the large number of children per adult, little time was available for anything aside from the routines of physical care. The girls who assisted the nurses accepted the work as a necessary evil and, in general, took little personal interest in the children as individuals. Few play materials were available and little attention was given to the teaching of play techniques. The children were seldom out of the nursery room except for short walks or short periods of time out of doors for fresh air.

At two years of age these children were graduated to the cottages. A rather complete description of "cottage" life is reported in the study by Skeels, Updegraff, Wellman, and Williams (5) on **A Study of Environmental Stimulation: An Orphanage Preschool Project**, from which the following excerpts are taken:

"Overcrowding of living facilities was characteristic. Too many children had to be accommodated in the available space and there were too few adults to guide them. . . . Thirty to thirty-five children of the same sex under six years of age lived in a "cottage" in charge of one matron and three or four entirely untrained and often reluctant girls of thirteen to fifteen years of age. The waking and sleeping hours of these children were spent (except during meal times and a little time on a grass plot) in an average sized room (approximately fifteen feet square), a sun porch of similar size, a cloak room, . . . and a single dormitory. The latter was occupied only during sleeping hours . . . The meals for all children in the orphanage were served in a central building in a single large dining room. . . .

"The duties falling to the lot of a matron were not only those involved in the care of the children but those related to



clothing and cottage maintenance, in other words, cleaning, mending, and so forth. . .With so much responsibility centered on one adult, the result was a necessary regimentation. The children sat down, stood up, and did many things in rows and in unison. They spent considerable time sitting on chairs, for in addition to the number of children and the matron's limited time, there was the misfortune of inadequate equipment. . . .

"No child had any property which belonged exclusively to him, except, perhaps, his tooth brush. Even his clothing, including shoes, was selected and put on him according to size. . . ." (p. 10-11)

From this it may be seen what a remarkable contrast there was between the environment of the experimental transfer group and the contrast group. Such a radical shift in environment as was experienced by each of the children in the experimental group would scarcely occur in an unselected sampling of children in their own homes more than two or three times in a thousand cases.

Following the completion of these research studies on preschool children, the orphanage has made radical changes in the program for the preschool child. Number of children per cottage has been reduced, thus alleviating to a great extent the overcrowded conditions. Each cottage now has two matrons with additional domestic service. The preschool has been made an integral part of the school system with all children of preschool age in attendance. With the assistance of the state emergency nursery school program a pre-preschool program has been set up for the children in the nursery under two years of age. A trained teacher, in addition to the regular nursing staff, spends full time with the infants providing a more enriched play and educational program.

#### MENTAL DEVELOPMENT OF CHILDREN IN EXPERIMENTAL AND CONTRAST GROUPS

The mental development of individual children in the experimental group is presented in Table 1. As the standard measure of intelligence the 1922 Kuhlmann Revision of the Binet was used, excepting in the cases of two or three tests on children who were four years of age or more where the Stanford-Binet (1916) was used. All examinations were made by trained and experienced psychologists. Test one was the measure of intelligence just prior to transfer. Tests two, three, and last test, were given at subsequent intervals of time following transfer. "Last test" is the test at the end of the experimental period, and represents the second, third, or fourth test, depending on the number of tests available at representative time intervals on a given child.

Similar data showing the mental growth of the individual children in the contrast group are presented in Table 2. In the column

TABLE 1

MENTAL DEVELOPMENT OF INDIVIDUAL CHILDREN IN EXPERIMENTAL GROUP AS MEASURED BY KUHLMANN-BINET INTELLIGENCE TESTS BEFORE AND AFTER TRANSFER

Case Number*	Before Transfer		Chronological Age, Months, at Transfer	After Transfer						Length of Experimental Period, Months	Change in IQ, First to Last Test
	Test 1			Test							
	Chronological Age, Months	IQ		2		3		Last			
				Chronological Age, Months	IQ	Chronological Age, Months	IQ	Chronological Age, Months	IQ		
1	7.0	89	7.1	12.8	113			12.8	113	5.7	+24
2	12.7	57	13.1	20.5	94	29.4	83	36.8	77	23.7	+20
3	12.7	85	13.3	25.2	107			25.2	107	11.9	+22
4	14.7	73	15.0	23.1	100			23.1	100	8.1	+27
5	13.4	46	15.2	21.7	77	32.9	100	40.0	95**	24.8	+49
6	15.5	77	15.6	21.3	96	30.1	100	30.1	100	14.5	+23
7	16.6	65	17.1	27.5	104			27.5	104	10.4	+39
8	16.6	35	18.4	24.8	87	36.0	88	43.0	93	24.6	+58
9	21.8	61	22.0	34.3	80			34.3	80	12.3	+19
10	23.3	72	23.4	29.1	88	37.9	71	45.4	79	22.0	+7
11	25.7	75	27.4	42.5	78	51.0	82**	51.0	82**	23.6	+7
12	27.9	65	28.4	40.4	82			40.4	82	12.0	+17
13	30.0	36	35.9	51.7	70	81.0	74**	89.0	81**	52.1	+45

\* Arranged according to age the time of first test from youngest to oldest.

\*\* Stanford-Binet IQ



marked "last test" is given the test on each child at the end of the period of study. This was either the third or fourth test, depending upon the number of available tests at representative time intervals on each child.

Mean, median, and standard deviation comparisons of mental growth from "first" to "last test" for experimental and contrast groups are presented in Table 3. Mean IQ at time of transfer was 64.3 with a median at 65. The average gain in intelligence quotient for the experimental group during the course of the experiment was 27.5 points with a median of 23. The mean IQ on "last" test was 91.8 with a median at 93. The difference between "first" and "last" tests yielded a critical ratio (Fisher's  $t$ ) of 6.3 or practical certainty of a true difference. Every child showed a gain, the range being from 7 to 58 points. Three children made gains of 45 points or more, and all but two children gained more than 15 points (Table 1).

The average chronological age at time of transfer was 19.4 months with a range from 7.1 months to 35.9 months, the median being 17.1 months. Length of the experimental period was from 5.7 months to 52.1 months with a mean of 18.9 months and a median of 14.5 months. The length of the experimental period was not a constant for all children, but depended upon the rate of development of the individual child. As soon as a child showed normal mental development as measured by intelligence tests and substantiated by qualitative observations, the experimental period was considered completed; the child's visit at the school for feeble-minded was terminated; and he was placed in an adoptive home or returned to the orphanage.

The mental growth pattern for children of the contrast group is quite the opposite from that of the experimental group. The mean IQ on "first" examination was 86.7, whereas on the "last" test it was 60.5, showing an average loss of 26.2 points. The critical ratio (Fisher's  $t$ ) was 6.1. The median IQ on "first" test was 90 and on "last test" 60, with a median of individual losses of 32.5 points (Table 3). With the exception of one child who gained two points in IQ from first to last test, all children showed losses, the range being from -8 points to -45 points. Ten of the twelve children lost 15 or more points in IQ (Table 2).

Mean comparisons of mental growth from "first" to "last test" for experimental and contrast groups are shown graphically in Figures 1 and 2. Since the first examinations on children of the experimental group were made about one month before transfer, the unbroken line has been drawn horizontally from chronological age at time of first test to the time of transfer. In Figure 1, since some children in the experimental group had only two tests, the same IQ would appear in the second and "last" test landmarks on the graph. Accordingly, in Figure 2, these have been separated. The unbroken line represents the gain in intelligence from time of transfer to second test and in-

TABLE 2

MENTAL DEVELOPMENT OF INDIVIDUAL CHILDREN IN CONTRAST GROUP AS MEASURED BY REPEATED KUHLMANN-BINET INTELLIGENCE TESTS OVER A PERIOD OF TWO AND ONE-HALF YEARS

Case Number*	Test								Length of Experimental Period, Months	Change in IQ, First to Last Test
	1		2		3		Last			
	Chronological Age, Months	IQ	Chronological Age, Months	IQ	Chronological Age, Months	IQ	Chronological Age, Months	IQ		
14	11.9	91	24.8	73	37.5	65	55.0	62	43.1	-29
15	13.0	92	20.1	54	38.3	56	38.3	56	25.3	-36
16	13.6	71	20.6	76	40.9	56	40.9	56	27.3	-15
17	13.8	96	37.2	58	53.2	54	53.2	54	39.4	-42
18	14.5	99	21.6	67	41.9	54	41.9	54	27.4	-45
19	15.2	87	22.5	80	35.5	74	44.5	67	29.3	-20
20	17.3	81	43.0	77	52.9	83**	52.9	83**	35.6	+ 2
21	17.5	103	26.8	72	38.0	63	50.3	60	32.8	-43
22	18.3	98	24.8	93	30.7	80	39.7	61	21.4	-37
23	20.2	89	27.0	71	39.4	66	48.4	71	28.2	-18
24	21.5	50	34.9	57	51.6	42	51.6	42	30.1	- 8
25	21.8	83	28.7	75	37.8	63	50.1	60	28.3	-23

\*Arranged according to age at time of transfer from youngest to oldest

\*\*Stanford-Binet IQ



**TABLE 3**

MEAN, MEDIAN, AND STANDARD DEVIATION COMPARISONS OF MENTAL GROWTH FROM FIRST TO LAST TEST FOR  
EXPERIMENTAL AND CONTRAST GROUPS

Measure	Chrono-logical Age, Months	Mental Age, Months	IQ	Chrono-logical Age, Months	Chrono-logical Age, Months	Mental Age, Months	IQ	Length of Experimental Period, Months	Change in IQ, First to Last Test
Experimental Group (13 Children)									
	Before Transfer			Transfer		After Transfer			
Mean	18.3	11.4	64.3	19.4	38.4	33.9	91.8	18.9	+27.5
Standard deviation	6.6	4.2	16.4	7.4	17.6	13.0	11.5	11.6	15
Median	16.6	10.8	65.0	17.1	36.8	30.0	93.0	14.5	+23
Contrast Group (12 Children)									
	First Test			Transfer		Last Test			
Mean	16.6	14.2	86.7		47.2	28.7	60.5	30.7	-26.2
Standard deviation	2.9	2.9	14.3		5.9	6.4	9.7	5.8	14.1
Median	16.3	13.6	90.0		49.3	29.3	60.0	28.8	-32.5

cludes all thirteen children. The broken line shows the rate of mental growth for six children having three tests reported and indicates the rate of growth from time of transfer to second test and from second test to third test. Since all children in the contrast group had at least three tests, such a division was unnecessary.

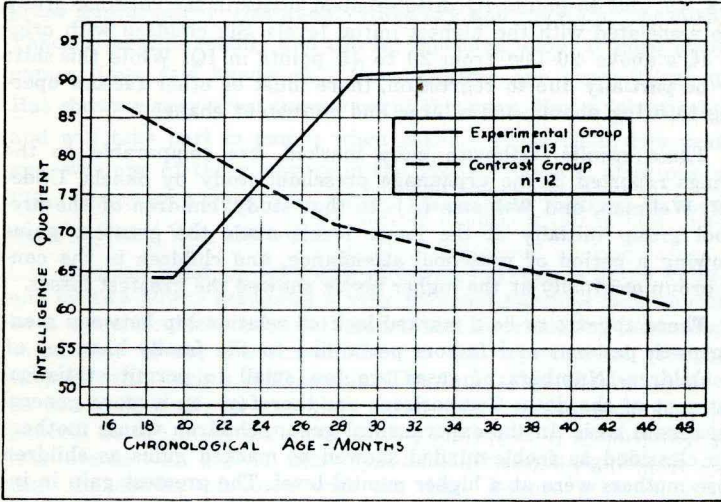
From Figures 1 and 2 and Table 1 it will be seen that as far as central tendencies are concerned, the greatest gain for children in the experimental group was made during the first ten months of the experimental period. Similarly, in Figures 1 and 2 and Table 2, the greatest loss for children in the contrast group was during the first year with a somewhat lower rate of loss during the second and third years.

In the following tabulation children in the experimental group have been arranged in the order of gains from the greatest to the least; children in the contrast group have been arranged in order of losses from the greatest to the least.

Case	Changes in IQ First to Last Test	Chronological Age, Months First Test	IQ First Test
<b>Experimental Group</b>			
8	+58	16.6	35
5	+49	13.4	46
13	+45	30.0	36
7	+39	16.6	65
4	+27	14.7	73
1	+24	7.0	89
6	+23	15.5	77
3	+22	12.7	85
2	+20	12.7	57
9	+19	21.8	61
12	+17	27.9	65
10	+ 7	23.3	72
11	+ 7	25.7	75
<b>Contrast Group</b>			
18	-45	14.5	99
21	-43	17.5	103
17	-42	13.8	96
22	-37	18.3	98
15	-36	13.0	92
14	-29	11.9	91
25	-23	21.8	83
19	-20	15.2	87
23	-18	20.2	89
16	-15	13.6	71
24	- 8	21.5	50
20	+ 2	17.3	81

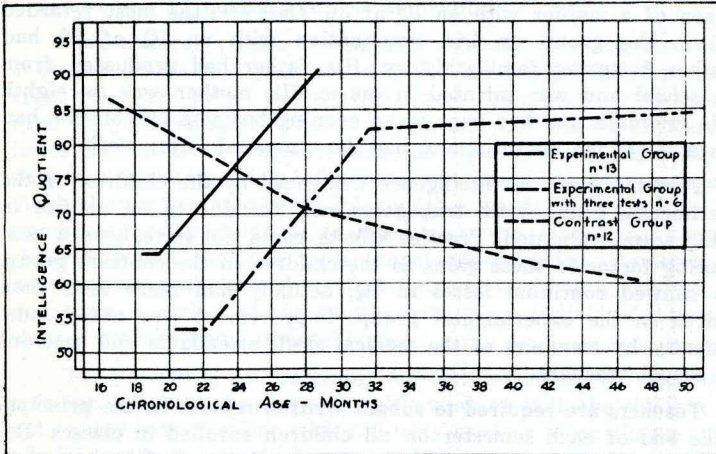
There is a tendency for children in the experimental group initially at the lower levels to make the greater gains. The three children classifying at the imbecile level on first examination made gains





**Figure 1**

Mean Comparisons of Mental Growth from First to Last Test for Experimental and Contrast Groups



**Figure 2**

Mean Comparisons of Mental Growth from First to Last Test for Experimental and Contrast Groups, Showing Experimental Group Having Three Tests

of 58, 49, and 45 points IQ. Also greatest losses in the contrast group were associated with the highest initial levels. Six children with original IQ's above 90 lost from 29 to 45 points in IQ. While this shift may be partially due to regression, there must be other factors operating to bring about such a large and consistent change.

These results, although more marked, are comparable to the findings reported in the orphanage preschool study by Skeels, Updegraff, Wellman, and Williams (5). In that study, children of the preschool group initially at the lower levels made the greatest gains following a period of preschool attendance, and children in the control group originally at the higher levels showed the greatest losses.

There appears to be a marked lack of relationship between mental growth patterns and factors pertaining to the family histories of the children. Numbers of cases are too small to permit statistical treatment of the data. Comparisons are therefore on a more general inspectional basis. In the experimental group, children whose mothers were classified as feeble-minded showed as marked gains as children whose mothers were at a higher mental level. The greatest gain in intelligence (58 points IQ) was made by Case 8 whose mother was known to be feeble-minded and had only gone as far as the second grade in school.

In the contrast group, the only child who failed to show loss in rate of mental growth (Case 20) from "first" to "last" test was the son of a mother with an IQ of 36. Case 24, the most retarded child in the group on first examination with an IQ of 50, had a rather flattering family history. His father had graduated from high school and was talented in music. His mother was an eighth grade graduate and had gone to an evening business school. She had been a telephone operator and had done general office work.

That the gains in intelligence evidenced by the children of the experimental group were true gains and not due to an artifice in testing seems validated. Practice effects could not have been a contributing factor to these gains as the children in the contrast group, who showed continual losses in IQ, actually had more tests than children in the experimental group. Improvement was noted independently by members of the medical staff, attendants and matrons and school teachers.

Teachers are required to submit written reports to the principal at the end of each semester on all children enrolled in classes. Repeated reference is made in these reports to the marked improvement of these children in the experimental group. The following excerpts are taken from such reports: Case 12 after one year preschool or kindergarten: "Well behaved, interested. Joins group for simple games and rhythms. From my observations she apparently possesses about average intelligence for a child her age." Later report: "Very



great improvement. Has good vocabulary and muscular coordination. Takes directions readily and can be depended upon. A good leader in games. Does fair handwork." Case 3, after one year: "Very quiet. Has shown a very great improvement this year. Has a fair vocabulary and will take part in games when asked." (This child, two years of age, was one of the youngest in the group.) Case 9, after one year: "Has improved a good deal. Enjoys games and rhythms. Is speaking quite a little. Very attentive."

A close bond of love and affection between a given child and one or two adults assuming a very personal parental role appears to be a dynamic factor of great importance. In evaluating these relationships, nine of the thirteen children in the experimental group were favored with such a relationship. The four other children tended to be less individualized and their adult relationships were more of a general nature involving more adults, the bonds of relationship being less intense with a given individual adult. It seems significant to note that the children favored with the more intense personal contacts made greater gains than those considered as being limited to the more general contacts. The nine children in the "personal" group made gains in IQ ranging from 17 to 58 points with an average of 33.8 points gain. The four children in the more general contact group made average gains of 14 points. Two children made gains of only 7 points, one 19 points, and one 20 points.

Two children (Cases 10 and 11), showed little progress on ward 7 over a period of a year and a half. This ward differed materially from the other wards in that there were from eight to twelve children of younger ages (3 to 8 years), and the older girls were of a lower mental level. The attendant on the ward was especially fine with young children, but, of course, was unable to give as much individual attention as was possible on other wards because of the large number of young children. At this time it was feared that these two children would continue to be hopelessly retarded. However, they were subsequently placed as singletons on wards with brighter girls, and after a period of six months with more individualization they showed marked gains in intelligence.

The possibility of "coaching" on test items may be ruled out as a factor. Adults and other older girls working with the children were not in any way familiar with the tests used or when they would be administered. Results in terms of IQ's were never given out; the only reports made were qualitative ones indicating the general improvement of the child.

As has been indicated, all thirteen children in the experimental group were considered unsuitable for adoption because of mental deficiency. Following the experimental period, seven of these child-

ren have been placed in adoptive homes. Of the remaining six, five are considered well within the range of normality and were returned to the orphanage. Only one child (IQ 77) will continue in residence at the school for feeble-minded for further observation as to subsequent mental development.

Of the children in adoptive homes, four have been examined following one year's residence in the foster home. These are Cases 1, 5, 7, and 8. Final IQ's are respectively as follows: 117, 94, 97, and 93. Three of the five children returned to the orphanage have been given an additional test following "last test" reported in Table 2. These are Cases 3, 10, and 11 with subsequent IQ's of 115, 84, and 85.

Accordingly, on a basis of last test reported, of the thirteen children two now classify as above average intelligence with IQ's of 117 and 115; five have IQ's between 90 and 100; five at the 80 to 90 level and only one child with an IQ below 80. No child is now considered to be feeble-minded.

In an evaluation of the contrasting mental growth patterns of children in the two groups, one is impressed by the marked relationship between rate of mental growth and the nature of the environmental impact. In the case of the contrast group, the psychological prescription was apparently inadequate as to kinds of ingredients, amounts, and relative proportions. Accordingly, the children became increasingly emaciated in mental growth as time went on.

Conversely, when the psychological prescription was radically changed, the children in the experimental group already retarded at the time of transfer showed marked improvement and either achieved or approached normal mental development after a period of time. The environment of the experimental group apparently included a more adequate prescription as relating to the kinds and proportions of ingredients needed by children of these young ages for normal mental development. It must not be inferred that the environment of the experimental group represented an optimum prescription. Perhaps even greater improvement would have resulted had there been greater facilities and more adequate knowledge of proportioning the ingredients operative in producing optimal mental growth. No instructions were given as to what should or should not be done with the children when they were placed on the wards. This was largely a matter of chance. The general prescription, however, did include certain unmeasured quantitative and qualitative ingredients such as love and affection by one or more interested adults; a wealth of play materials and ample space and opportunity for play with supervision and direction; varied experiences such as preschool or kindergarten attendance and opportunity to be in group gatherings; and a number of other diversified experiences associated with the opportunities afforded a child



in a rather adequate home situation. This rather general prescription proved to be conducive to increase in rate of mental development.

With more adequate knowledge, as to the correct proportioning of such ingredients in relation to the specific inadequacies or gaps in the developmental pattern of a given child, possibly even more marked mental improvement could have been brought about.

That such increase in rate of mental development may be brought about at older ages through provision of a more adequate psychological prescription is suggested in the studies of Kephart (3) at the Wayne County Training School. He found that boys of fifteen to eighteen years of age showed increase in rate of mental growth following environmental changes pointed toward alleviation of the developmental gaps or inadequacies.

It therefore appears that there is an added challenge in the education of the so-called "functional" feeble-minded, that is those not evidencing physiological deficiencies or organic diseases. Not only should the educational program of a school for feeble-minded include the teaching of skills at the individual's mental level, but it should be so individualized as to provide for the specific developmental needs of a given child with the strong possibility that the level of mental capacity can be materially augmented.

#### SUMMARY

This study attempts to determine the effect on mental growth of a radical shift from one institutional environment to another which provided superior stimulation. The experimental group included thirteen mentally retarded orphanage children from one to two years of age, placed singly or by twos on wards with brighter, older girls. This environment was stimulating and had many adult contacts. The mean IQ of the group at time of transfer was 64.3. As a contrast group twelve average and dull normal children (mean IQ 86.7) in an orphanage nursery were studied. Few adult contacts were afforded with limited opportunities for play and development.

Results and conclusions are as follows:

1. Over a period of two years the mean level of intelligence of the experimental group increased markedly while that of the contrast group showed an equivalent decrease. The experimental group made an average gain of 27.5 points while the contrast group showed a mean loss of 26.2 points.
2. Critical ratios ( $t$ 's) based on differences between first and last tests for experimental and contrast groups were 6.3 and 6.1 respectively.
3. A change from mental retardation to normal intelligence in children of preschool age is possible in the absence of organic disease or physiological deficiency by providing a more adequate psychological prescription.



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4. Conversely, children of normal intelligence may become mentally retarded to such a degree as to be classifiable as feeble-minded under the continued adverse influence of a relatively nonstimulating environment.

5. An intimate and close relationship between the child and an interested adult seems to be a factor of importance in the mental development of young children.

6. In a child placing program if children are to be withheld from placement in adoptive homes pending further observation of mental development, it is imperative that careful consideration be given to the type of environment in which they are to be held.

7. The possibility of increasing the mental capacity of "functionally" feeble-minded children should be considered as an essential objective in setting up an individualized treatment and educational program in a school for feeble-minded.

#### REFERENCES

1. Binet, Alfred: Les idees modernes sur les enfants. Paris: Ernest Flammarion, 1909. Pp. 346. Cited from Stoddard, George D.: The IQ: Its Ups and Downs. Educ. Rec., 1939, 20, 44-57. (Supplement for January)
2. Fillmore, Eva A.: Iowa tests for young children. Univ. Iowa Stud., Stud. in Child Welfare, 1936, 11, No. 4, Pp. 58.
3. Kephart, Newell C.: The effect of a highly specialized institutional program upon the IQ in high grade mentally deficient boys. Unpublished study, Wayne County Training School, Northville, Michigan.
4. Skeels, Harold M., and Fillmore, Eva A.: The mental development of children from underprivileged homes. Ped. Sem. & J. Genet. Psychol., 1937, 50, 427-439.
5. Skeels, Harold M., Updegraff, Ruth, Wellman, Beth L., and Williams, Harold M.: A study of environmental stimulation: An orphanage preschool project. Univ. Iowa Stud., Stud. in Child Welfare, 1938, 15, No. 4, Pp. 190.
6. Skodak, Marie: Children in foster homes: A study of mental development. Univ. Iowa Stud., Stud. in Child Welfare, 1939, 16, No. 1, Pp. 155.