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A STUDY OF THE CHANGE IN INTELLIGENCE DISTRIBUTION OVER A TWENTY YEAR PERIOD IN CENTRAL IOWA.

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DESCRIPTORS- *INTELLIGENCE QUOTIENT, NONFARM YOUTH, *RURAL YOUTH, RURAL AREAS, RURAL POPULATION, *RURAL FARM RESIDENTS, MAHASKA COUNTY IOWA,

THERE WAS A STATISTICALLY SIGNIFICANT RISE IN THE MEAN IQ SCORE OF CHILDREN WHOSE PARENTS OBTAINED THEIR LIVING BY FARMING IN MAHASKA COUNTY, IOWA, DURING THE TWENTY YEARS PRECEEDING 1961-63. HOWEVER, THIS INCREASE WAS NOT PARALLELED BY THE NONFARM CHILDREN LIVING WITHIN THE SAME RURAL COMMUNITY. SELECTIVE MIGRATION WAS SHOWN TO BE AN ACTIVE FACTOR IN THIS INCREASE, BUT NOT THE ONLY OR PERHAPS EVEN THE MOST IMPORTANT FACTOR INVOLVED. SOME FACTOR OR FACTORS OF ENVIRONMENT POSSESSED BY THE FARM CHILDREN AND A SEGMENT OF THE NONFARM POPULATION APPEARS TO PROMOTE THIS INTELLECTUAL GROWTH. (CL)

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A STUDY OF THE CHANGE IN INTELLIGENCE DISTRIBUTION OVER A TWENTY YEAR PERIOD IN CENTRAL IOWA

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Abstract

This was a five part investigation of the change in intelligence distribution in a 186 square mile areas of rural Iowa between the years 1941-43 and 1961-63. Sections one and two identify the changes having taken place while sections three through five identify some of the causes. The sample consisted of 1,975 students. The data revealed that the intellectual level of the children whose parents obtained their living from farming had risen significantly during the twenty-year period. This was not true of the control group, which consisted of all the rural children of the same geographic area whose parents did not farm. The mean of the control group remained constant, the upper 20 percent rose while the lower 20 percent went still lower. Selective migration was shown to be an active factor in this process as was an unidentified factor or factors in the environment of the farm children

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From studying Army Alpha Data, Johnson (1948) reported the average IQ of the state of Iowa to be 102. Five years ago a study of intelligence in Iowa by Showwalter (1959) showed the mean IQ of the Iowa school child to be 110 as compared with the earlier score of 102, and the national average of 100 from the Army Alpha Data. In the study by Showalter the children were divided into strata by the size of the community. There was a tendency for the percent of IQs above 125 to increase with the size of the community with the exception of the last strata (cities areas 100,000). This meant that the percentage of IQ's above 125 was smallest in sparsely populated areas.

Since World War II, economic conditions for farm families have changed drastically. Eldridge (1962) stated that though nonfarm income rose substantially during the 1950-60 period, total farm income dropped by 25 percent. Russell (1960) reports that the cost-price squeeze was responsible for 40 percent of the farm auctions. Between 1940 and 1961, in Mahaska County, Iowa, the locale of the study, 547 farms ceased to exist.

In 1949 the average capital managed by a single farm operator in Mahaska County was $37,740. According to Hogged (1963) only ten years later this figure had risen to $62,300. All those who could not keep pace with this increased demand for capital were forced to drop out of farming.

The problem under study was whether these economic conditions cuased migration to be selective enough to affect the intellectual level of the remaining farm families and rural community.

PROCEDURES

Definition of Terms

Farm children. Those children whose parents' chief source of income

is derived from farming.

Nonfarm children. Not used in the usual sense of the census definition, but refers to those children living within the rural community, in town, village, or open country, whose fathers' occupations are other than farming.

Control group. Used interchangably with the term "non-farm". In the sense of being a group which had had similar socio-economic conditions as the farm group, except for their father's occupation, they served as a control group.

Community. The area in north Mahaska County, Iowa, which was served by the Lacey and New Sharon High Schools prior to 1958, and which, since that year, was incorporated into the North Mahaska Community School District. It consists of approximately 186 square miles and in the 1962-63 school year had an enrollment of about 727 students.

Sources

The sources used were the permanent records and cumulative records of the North Mahaska Schools, the permanent records of the County Superintendent of Schools of Mahaska County, the Alumni records from the Lacey and New Sharon High Schools, the Township assessors lists, and personal interviews.

Measurements.

The measurements used were the Otis Quick-Scoring Mental Test, the Kuhlman-Anderson Intelligence Test, the California Test of Mental Maturity, the Henmon-Nelson Intelligence Test, the Stanford-Binet Intelligence Test, the Detroit Intelligence Tests, The Wechsler Intelligence Scale for Children, and in a very few cases, unnamed intelligence tests. Where more than one test score was available, the following procedure was used: Only group scores were used. In cases of more than one score being recorded, the highest of the scores was used except in the study of

families, when the mean score was used. Regardless of score, an unnamed test score was never used unless it was the only score available.

The sample included the ninth grade students of Lacey and New Sharon High Schools, and the later formed North Mahaska High School from the year 1931 through 1963, and those students enrolled in grades three through eight in the North Mahaska Schools during the 1962-63 school year. This made a total of 1,975 cases.

Tests of Significance

In the comparisons of the ranges of IQ test scores, the significance of the differences between means from large samples suggested by Garrett (1963) was used or was his formula for the significance of the difference between two percentages (1963, p. 127 & p. 135)

FINDINGS AND COMPARISONS

The study was comprised of five separate but related sections: the twenty-year study, the seventeen-year study, emigration, immigration, and family pairings.

The Twenty-Year Study

The twenty-year period was chosen for three reasons: (1) it approximates a generation, (2) when considering economic pressure as a factor in migration, it formed the optimum in contrast because of the World War II prosperity in agricultural areas, (3) prior to 1941, the percent of data available was markedly less, giving less conclusive evidence.

Sample. In the twenty-year study, two samplings, one at the beginning and the other at the end of a twenty year interval were used. The sample consisted of the entire ninth grade classes in the New Sharon and Laceye High Schools for the years of 1941-43, 86 individuals. The second part of the sample was the complete ninth grade classes for the same geographic

within the North Mahaska Community School District, for the years 1961-63, 113 students. Complete data were available for 82.5 percent of the pupils from the 1941-43 period; 94.6 percent for the 1961-63 period.

Drop-out factor. To ascertain whether the drop-out rate between eighth grade and ninth would be sufficiently greater in the early period to bias the results, detailed investigations were conducted of every child graduating from eighth grade during the years 1939-42 and 1958-62, in the three interior townships, Prairie, Union, and Adams. These townships made up more than half of the total area, were centrally located in the district, and extended nearly the full length of the district from north to south. For these reasons, it was considered that they were representative of the district as a whole. The eighth grade graduates from these three townships were, then, compared with the enrollment in ninth grade in the near-by high schools, of New Sharon, Lacey, Barnes City, Oskaloosa, and Pella, for the years 1940-45 and 1960-63. The added years were a precaution against missing any who repeated a grade or stayed out of school to work, which was a rather common practice at the 1938-45 period. The drop-out rate was 10.6 percent for the years 1941-43; zero percent in the 1961-63 period. This drop in percentage was statistically significant at the .01 level of confidence. Farm children represented 64 percent of the drop-outs in 1941-43. Only 36 percent of the drop-outs were girls.

Community change. Though the drop-out factor might tend to make the earlier group more selective, the mean IQ score of the classes of 1941-43 was 104.3, as compared with a mean of 109.7 for the years of 1961-63. The modal IQ rose from 104.5 in 1941-43, to 114.5 in 1961-63. In 1941-43, 32.4 percent of the community's children scored above 110. In 1961-63, this percentage had risen to 59.8 percent, which was significant at the .01 level. In 1941-43, 7 percent of the entire group had IQ scores below

90. By 1961-63, this had increased to 11.2 percent, a marked, but not statistically significant increase. For the community, as a whole, the mean rose, while both extremes increased. See Table 1, following.

Table 1. Results of the Twenty-Year Study-Community Change in IQ Test Scores

	1941-43	1961-63	Diff.
Number of cases	86	113	+27
Percent of data complete	82.5	94.6	+12.1
Percent of IQ scores above 110	32.4	59.8	+27.4**
Percent of IQ scores below 90	7.0	11.2	+ 4.2
Mean IQ of the community	104.3	109.7	+ 5.4
Modal IQ of the community	104.5	114.5	+10.0
Mean of the high 20 percent	119.0	128.1	+ 9.1
Mean of the low 20 percent	90.5	87.3	- 3.2

Differences not statistically significant unless starred.
**Statistically significant at the .01 level of confidence.

Change in farm population. As the study was particularly interested in the evolution of the IQ score distribution of the farm population, the children of those actually engaged in farming as their chief occupational pursuit were segregated into one group. To form a control group, with which to make comparisons, all other children in the area were placed in a second group. Their parents consisted of business men, truckers, and laborers. The farm group and the control group or nonfarm group went to the same schools, churches, traded at the same stores, participated together in the same forms of recreation and community activities and had the same forms of communication and transportation. Economically, there were few extremes in either group, with the exceptions occuring to about the same extent in both farm and nonfarm groups. The mean IQ score of the farm group in 1941-43 was 104.7. The mean for the control group was 104.0. The higher drop-out rate of the farm children of the 1941-43 period may have biased the sample slightly in favor of the farm group. If that were true, it would most certainly eliminate any advantage

which they may appear to have had at that period.

In 1961-63, 96.3 percent of the data was complete. The control group's mean IQ score was 104.7, practically the same as in 1941-43. The farm group's mean rose from the 104.7 of the 1941-43 period, to 113.3 for the 1961-63 period, a significant increase at the .05 level. The high 20 percent of the farm group and the control group made a parallel increase. The farm group's increase exceeding that of the control group by 2.2 points. The low 20 percent of the two groups moved contrarily, however. The farm group's mean for the low 20 percent moved from 93.3 in 1941-43 to 97.1 in 1961-63. The control groups' low 20 percent dropped from 87.8 to 79.4 during this same period. The difference in these two groups in 1961-63 was significant at the .01 level.

In 1941-43, 30.2 percent of the farm group and 35.7 percent of the control group had IQ scores above 110. By 1961-63, the farm group's percentage above 110 had risen to 65.5, a significant increase at the .01 level. The nonfarm group's percentage above 110 had risen to 48.1, which was a marked increase, but did not reach statistical significance. See Table 2, and Figure 1, following.

Table 2. Results of the Twenty-Year Study-Comparison of Farm and Nonfarm IQ Scores

		Farm	Nonfarm	Diff.
1941-43	Number of cases	43	28	-15
	Percent of data	78.6	93.3	+14.7
	Mean IQ score	104.7	104.0	- 0.7
	Percent above 110	30.2	35.7	+ 5.5
	Percent below 90	2.3	14.3	+12.0
	Mean of high 20 percent	118.0	119.1	+ 1.1
	Mean of low 20 percent	93.3	87.8	- 5.5
1961-63	Number of cases	55	51	- 4
	Percent of data	96.3	96.3	0.0
	Mean IQ score	113.3	104.7	- 8.6*
	Percent above 110	65.5	48.1	-17.4
	Percent below 90	1.8	21.2	+19.4**
	Mean of high 20 percent	129.2	128.1	- 1.1
	Mean of low 20 percent	97.1	79.4	-17.7**

'Differences not statistically significant unless starred.
*Statistically significant at the .05 level of confidence.
**Statistically significant at the .01 level of confidence.

The Seventeen-Year Study

Realizing that the first study had used a comparatively small sample, the study was conducted again using a five year period as a sampling at both the beginning and end of a seventeen year interval.

Sample and procedure. All students enrolled as ninth graders in Lacey and New Sharon High Schools during the years 1941-46 were compared with those from the identical geographic area within the North Mahaska Community School District during the years 1958-63. This yielded a total of 432 cases, 201 from the first period and 231 from the latter period.

Findings. The seventeen-year study confirmed the trends observed in the twenty-year study. For the community, as a whole, the mean IQ was 106.7 for the 1941-46 period, but had risen to 110.6 during the last five year period.

In 1941-46, the low 20 percent of the farm group had a mean score of 93.1: the nonfarm group, 89.0. By 1958-63, the low 20 percent of the farm group had risen from 93.1 to 95.7. The mean of the low 20 percent of the control group dropped from 89.0 to 86.1 during the same interval.

In 1941-46, the high 20 percent of the farm students had a mean score of 124.7; the control group's high 20 percent had a mean of 123.7. By 1958-63, the mean of the high 20 percent of the farm group had risen to 130.2; the control group to 128.7, nearly the same increase for both groups. Of the farm group, 3.9 percent scored below 90 in 1941-46; 2.2 percent in 1958-63. The nonfarm group's percentage increased from 12.3 percent in 1941-46, to 14.4 percent below 90 in 1958-63, the two groups moving in opposite directions just as had been noted in the twenty-year study.

The percentage scoring above 110, rose in both farm and nonfarm groups. In 1941-46, 37.5 percent of the farm group had IQ test scores above 110. This increased to 65.7 percent by 1958-63, which was significant at the .01 level. During the same interval, the nonfarm group's percentage scoring above 110 rose from 37.0 to 48.1 percent, which is a large but not statistically significant increase. See Table 3, following. In both the 20 year study and the 17 year study the girls scored higher than did the boys at each comparision.

Emigration

If, as had been indicated by other earlier studies, the more capable individuals tend to migrate from a community and the less capable and less well educated tend to remain and reproduce, and if parents, except for a slight regressive tendency, produce children similar to themselves, one would expect the mean IQ of the community to lower slightly. As this did not appear to be occurring, another comparison was made.

Sample and procedure. The records of all those who had been enrolled as ninth graders in the New Sharon and Lacey High Schools between the years of 1941-53 were examined, a total of 525 cases. No records were used subsequent to 1952 to insure the completion of educational plans and the establishment of a permanent residence following high school graduation. Of the 525 cases, school records were incomplete in 75 cases and 13 were deceased. Of the remaining 437, whose records were complete, all were traced. They were divided into two groups, farm and non-farm, according to their fathers' occupations. Those two groups were then separated into three sub-groups each: (group FA), those farm children who stayed on in the community to farm; (group FB), those farm children who

Table 3. Results of the Seventeen-Year Study Comparison of Farm and Nonfarm IQ Scores:

	1941-46	1958-63	Diff.
Number of cases	201	231	+30
Mean IQ score of community	106.7	110.6	+3.9
Percent scoring below 90			
Farm group	3.9	2.2	-1.7
Nonfarm Group	12.3	14.4	+2.1
Percent scoring above 110			
Farm group	37.5	65.7	+28.3**
Nonfarm Group	37.0	48.1	+11.1
Mean IQ score of low 20 percent			
Farm Group	93.1	95.7	+2.6
Nonfarm Group	89.0	86.2	-2.8
Mean IQ score of high 20 percent			
Farm Group	124.7	130.2	+5.5
Nonfarm Group	123.7	128.7	+5.0

Differences not statistically significant unless starred.
**Statistically significant at the .01 level of confidence.

stayed on in the community in a nonfarm occupation; (group FC), those farm children who left the community; (group NA), the nonfarm children who stayed on in the community in a nonfarm occupation; (group NB), the nonfarm children sho stayed in the community but migrated to a farm; and finally, (group NC), those nonfarm children who left the community. A total of six groups were, thus, formed on the basis of their own occupations in 1963.

Findings. In group FA, only 21.6 percent of those reared on a farm were able to stay on a farm in the same community and pursue farming as their own occupation. The mean IQ of this group was 105.5. Of the 78.4 percent leaving the farm, 7.5 percent stayed on in the community in a nonfarm occupation, group FB. The mean IQ score of this group was 106.1 the mean score of those leaving the farm to move outside the community, group FC, was 108.4. Though not statistically significant, it conforms to previous studies in that on an average, those with the most potential travel farthest.

This trend was also shown by the nonfarm children. Only 15.2 percent of this group stayed on in the community in a nonfarm occupation. The mean IQ score of those who did, group NA, was 100.1, the lowest of the six groups. Those nonfarm children leaving the community, group NC, averaged 107.7. The remaining group, group NB, thoselnonfarm children who migrated to farms within the community, had a mean IQ score of 108.8, the highest of any of the six groups, though not significantly so. The highest scoring group staying within the community and migrating to a farm runs counter to the theory of the ablest moving the farthest and is a type of selective migration which raises the level of the farm group at the expense of the nonfarm population and helps maintain the level of the community, as a whole. See Table 4 following.

TABLE 4 RESULTS OF THE STUDY OF EMIGRATION

	Group		No. of cases	Percent of total	Mean IQ	Mean IQ of all remaining in community
Farm Children 292 cases	FA	Remained in the community to farm	63	21.6	105.5	105.1
	FB	Remained in the community in a nonfarm occupation	22	7.5	106.1	
	FC	Moved from the community	207	70.9	118.4	
Nonfarm Children 145 cases	NA	Remained in the community in nonfarm occupations	22	15.2	100.1	
	NB	Remained in the community but moved to a farm	17	11.7	108.8	
	NC	Moved from the community	106	73.1	107.7	

Immigration

to pursue further, the factor of reverse migration--farm immigrants, a study of all those sho had moved into the community was made.

Sample and procedure. All the Children enrolled in the North Mahaska Community School District in grades three through ten during the 1962-63 school year were used as a sample, 493 cases. All the IQ test score data was complete and 100 percent of their parents were traced as to prior residence. The sample was then divided into three groups: (group R), resident, those whose parents, one or both, had attended school in this same geographic area, either grade or high school; (group IF), immigrants to farms, children whose parents immigrated to farms within the community since adulthood; and finally (group IN), immigrants to nonfarming occupations, children whose parents immigrated to nonfarm occupations within the community since adulthood. (Group IF, immigrants to farms should not be confused with group NB, immigrants to farms in the study of emigration. They were entirely separate groups.) There were 345 in the resident group, 56 in the group immigrating to farms, and 92 in the group immigrating to nonfarm occupations. The parents of the resident children (group R) made up a fourth group of 101, (group P).

Findings. The mean IQ score of those immigrating to farms, group IF, was 109.6, which is higher than that of those immigrating to nonfarm occupations, group IN. The mean score of group IN was 106.4. This finding, though not high enough to be statistically significant, tends to substantiate the findings of the study of emigration, that there exists a positive selectivity in the farm immigration.

The mean IQ score of the resident group of students was 112.1. That of their parents was 104.9. Though not statistically significant, it was

certainly a noticable increase which suggested that an actual increase in IQ test scores might occur from one generation to the next and led to the study of family pairings. See Table 5, following.

Family Pairings

Since it appeared that instead of a slight trend toward the mean, the second generation of residents were scoring noticeably higher than the first, it seemed worthwhile to examine this factor, by excluding marriages to persons outside the community and checking the result.

Sample and procedure. All the records of the ninth graders in the New Sharon, Lacey, and the more recently formed North Mahaska High Schools from the year 1931 through 1963 were examined. Those children enrolled in grades three through eight during the 1962-63 school year were also included, making a total of 1,976 individuals. From this group, all the families were selected from which there was a complete set of data on the father, mother, and all their children who would have reached school age. This yielded 26 families, consisting of 52 parents, and 55 children, a total of 107 individuals.

In this study, a definite change was made in manner of recording IQ test scores for the following reasons: (1) the prior section concerning immigration had already shown the childrens' scores to be considerably higher than that of the parent group when the top score was used; (2) previously, the comparisons had been concerned with large groups of parents and offstpring in which occasional spuriously high or low scores average out. In the present comparisons, where a family consisted of only two parents, such could not be assumed to be sufficiently operative;

TABLE 5 RESULTS OF THE STUDY OF IMMIGRATION

Total no. of cases		Group	No. of cases	Percent of total	Mean IQ
493	R	Children whose parents (one or both) had attended school in the community	345	70.0	112.1
	IF	Children whose parents had immigrated to farms in the community since adulthood	56	11.4	109.6
	IN	Children whose parents had immigrated to nonfarm occupations in the community since adulthood	92	18.7	106.4
101	P	Parents of Group R	101	--	104.9

(3) it was not primarily the purpose of this study to establish the truest measure of the offsprings' intelligence, but to remove all factors which might, in any way, bias the results in favor of the offspring.

It was, therefore, decided to depart from the established procedure, and treat the data with the utmost conservativism, knowing that if even then, an increase persisted, the increase would, in all probability, be actually considerably greater than measured by this particular comparison.

In accordance with this policy, the IQ test scores for each child were averaged and the mean rather than the top score recorded. From these means, the mean for all the children of one family was figured and compared with the mean of their own two parents. The mean for the entire parent group was also compared with the mean for the entire group of offspring.

These families were then sub-divided into farm and nonfarm families, according to the fathers' occupations, and the same comparisons made on a farm-nonfarm basis.

Findings. In 86.2 percent of the cases the mean of the offspring exceeded that of their own parents. See Tables 6 and 7 following.

Table 6. Results of Family Pairings

Number of records examined	1,976
Number of families isolated	26
Number of offspring	55
Number of parents	52
Mean IQ score of the offspring	110.7
Mean IQ score of the parents	105.3
Number of points offspring exceeded parents	5.4
Percent of cases in which offspring's IQ score exceeded that of parents	86.2

Table 7. Results of Family Pairings on a Farm-Nonfarm Basis

	Farm Families	Nonfarm Families	Diff.
Number of families	12	14	+2
Number of offspring	23	33	+10
Number of parents	24	28	+4
Mean IQ score of offspring	124.6	109.9	-14.7
Mean IQ score of parents	105.6	105.1	-00.5
Number of points offspring's mean exceeds that of parents	19.0	4.8	-14.2
Percent of offspring exceeding parents	91.6	79.3	-12.3

Differences not statistically significant unless starred.

Summary

There has been a statistically significant rise in the mean IQ score of farm children during the twenty years preceeding 1961-63. This increase has not been paralleled by the nonfarm children living within the same rural community. Selective migration has been shown to be an active factor in this increase but not the only or perhaps even the most important factor involved. Some factor or factors of environment possessed by the farm children and a segment of the nonfarm population appears to promote this intellectual growth.

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