York, 1957), pp. 54–56. The energy that does propagate near the surface with the compressional wave velocity has $G(d) = d^{-2}$, so it decays even more quickly than spherically diverging compressional waves.
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14. All surface disturbances of the sand (a single pulse from a piezoelectric transducer and walking and burrowing movements of insects) produced one or a series of wave pulses. Each pulse contained a burst of early-arriving, short-period *P*-waves followed by late-arriving, longer-period Rayleigh waves (Figs. 1 and 2).
15. These ablations did not alter normal ambulatory movements or the accuracy of the turning response to direct tactile stimulation of the tarsi. Thus, it is unlikely they interfered with motor control mechanisms for turning.
16. I thank Drs. R. Farley and F. Schwab for assistance in design and execution of this work. I also thank them and Drs. H. Shorey and S. Beihler for critical reading of manuscripts. An Environmental Sciences predoctoral fellowship partially supported this research.
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Childhood IQ's as Predictors of Adult Educational and Occupational Status

Abstract. *IQ's between 3 and 18 years of age were used to predict attained education and occupational status after 26 years of age. By the second grade these predictive correlations approached those that have been obtained with contemporaneous adult IQ's, especially for occupational status. However, they were not high enough for practical purposes requiring long-term prediction for individual normal children.*

Many uses of intelligence tests scores (IQ's) are based on the assumption that children's IQ's reveal something of their adult potential for educational and occupational success. But do the tests predict well enough to be used in that way? Jencks and his colleagues (*1*) recently reviewed the sparse evidence on the predictive validity of IQ tests and found that the correlations between school-age IQ and indices of adult educational and occupational success rarely exceed .60, not high enough for practical purposes requiring long-term prediction. Below we examine evidence on this issue from the Fels Longitudinal Study.

While many of the correlations reviewed by Jencks were based on large samples representing a wide spectrum of socioeconomic classes, often only dichotomous indices of educational or occupational attainment were used (for instance, blue versus white collar), the tests typically had been given at only one age during childhood, and data were often available only for males. The Fels sample contains families from the top 85 percent of the socioeconomic scale and is somewhat skewed to the right in educational attainment, but it has the advantage that parents and children of both sexes were assessed, over a wide age range, with more accurate procedures than has been typical of many previous reports. An important result of the research reported here is its general consistency with the data reviewed by Jencks.

All Fels subjects who had reached at least 26 years of age, about whom sufficient information was available to determine a Hollingshead scaled score for attained adult education and occupation (*2*), and who had had at least one IQ determination between 3 and 18 years of age were included in the sample. There were 94 males and 96 females who qualified, and correlations with later attainment could be determined from childhood IQ's at each of 16 ages, based upon 46 to 90 subjects of each sex.

These subjects were born between 1930 and 1943. They scored somewhat above average in IQ (mean of 117, varying somewhat with age) but with average variability (S.D. = 15.9). Of the females, 3 percent had not graduated from high school, 31 percent had gone through high school but not beyond, and 34 percent graduated from college. The comparable figures for males were 1 percent, 22 percent, and 56 percent. Further details of this subject population are given elsewhere (*3*, *4*).

The mental test data available included Pinneau corrected Stanford-Binet IQ (1937) scores at 3, 3½, 4, 4½, 5, 5½, 6, 7, 8, 9, 10, 11, and 12 years (forms L and M were given at alternate ages), Wechsler-Bellevue full-scale IQ at 13 and 16 years, and the total scores from the Primary Mental Abilities (PMA) test at 18 years. Cross-age correlations indicated that the Binet and the Wechsler tests were quite similar to each other but somewhat different from the 18-year PMA, though the PMA is probably as faithful a measure of

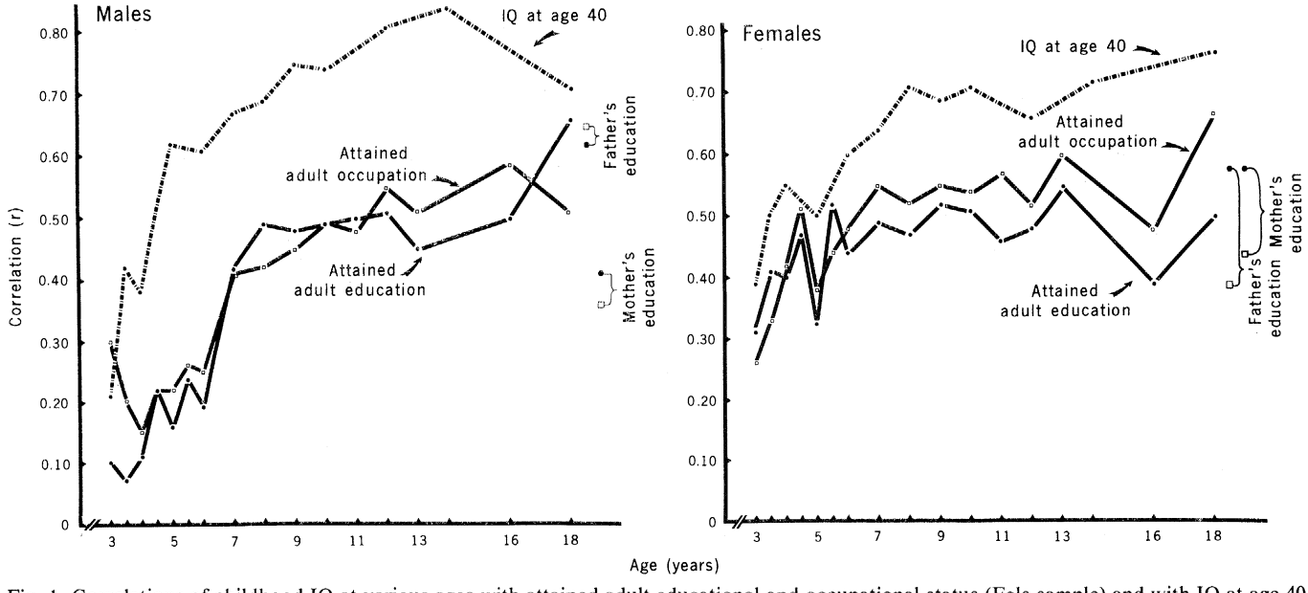

Fig. 1. Correlations of childhood IQ at various ages with attained adult educational and occupational status (Fels sample) and with IQ at age 40 years (Child Guidance sample). Also, correlation of fathers' and mothers' education with offsprings' adult occupational (open square) and adult educational (filled circle) status.

the general intelligence factor as are the other two. In addition, Hollingshead scaled educational and occupational scores were available from information obtained on the subjects after age 26 years and on their fathers and mothers when the subjects were children (*5*). Interrater reliabilities were determined for the six Hollingshead scores on a subset of 26 cases and were acceptable (r's for education were 1.00, .92, and .96; for occupation, .82, .84, and .94).

Figure 1 shows the correlations in each sex between individual IQ at various ages in childhood and individual education and occupation ratings in adulthood. Also shown are the correlations between the educational status of the subjects' parents and the subjects' education and occupation ratings as adults. For comparison, Honzik's (*6*) correlations between childhood IQ and IQ at age 40 in the Berkeley Child Guidance Study (N's range from 50 to 70 per age group per sex, with a median of 62) are plotted.

The IQ correlations with attained education and occupation rise until ages 7 to 8, especially for males. Thereafter they remain fairly stable at approximately .50 (± .10). The r's observed in the Fels sample are quite consistent with the maximum of .60 suggested by Jencks (*1*), despite large differences in the size and socioeconomic distribution of the samples and in the precision and frequency of the assessments. They are also consistent with results from a recent large Swedish study (*7*).

Childhood IQ predicts adult IQ much better than it predicts adult educational and occupational attainment. Whereas the correlations with adult IQ are typically in the range of .70 to .85, those with success criteria are approximately .50 (± .10). However, this difference must be put into perspective. Consider that the contemporary correlation between adult IQ and adult occupational status approximates .50 (*8*). If these contemporaneous validity coefficients are taken as maxima, it is remarkable that the correlations of childhood IQ with the adult criteria are approximately at maxima (that is, .50) even before the child has progressed beyond the second grade. But while correlations of .50 may be deemed good on psychometric grounds, especially considering the long prediction interval and the expected maxima for such values, they are probably not sufficiently high to warrant using the IQ's of normal individual children for predictive purposes that might result in limiting their educational opportunities over a substantial period of development. For the Fels sample, 64 to 84 percent of the variability in adult attainment is not reflected in childhood IQ's.

One can only speculate on why these contemporaneous and predictive correlations are modest in value. One of the many possible factors is that bright but disadvantaged children are not able to continue their education, whereas less bright but advantaged children can. If this is true, then there should be a relationship between father's occupation (as a crude index of income, which datum was not available in the Fels study) and offspring's attained education even after childhood IQ has been regressed from the attained education rating. For the ages 12 to 18 these part correlations ranged between .14 and .27 (three of four r's, $.10 > p > .01$, one-tailed) for males and between .26 and .39 for females (all four r's, $.02 > p > .0005$, one-tail). These values suggest that factors associated with father's occupation other than the child's IQ do relate to the child's attained education.

It should be noted in Fig. 1 that the correlations display greater developmental change for males than for females, with a major surge in predictive power at 6 to 7 years of age for males. Other data indicate that this is a developmental period of considerable transition in mental skills (*9*), and inflections in the developmental patterns of IQ are common at these ages (*4*, *10*). This is also the age at which most of these children began formal schooling.

Note also that mothers' education predicted daughters' educational and occupational attainment better than sons'. Perhaps educated and noneducated mothers differed considerably in their effort to encourage academic and occupational achievement in their daughters at a time when it was not as common for girls to attend college or pursue careers as it was for boys.

Attempts to combine father's and mother's education level to predict child's attained education produced coefficients (for males $R = .62$, for females $R = .63$) not substantially higher than did father's education alone (for males $r = .62$, for females $r = .58$). Nor did combining father's education and child's IQ elevate predictions. For example, these multiple correlations were highest and most consistent between 12 and 18 years, when they averaged .67 for males and .63 for females. Therefore, for sheer predictive purposes father's education level was more accurate than the child's own IQ, which contributed no substantial additional predictive power.

All the relationships depicted in Fig. 1 were reappraised for the possibility that they might have been influenced by secular changes or by the fact that adult achievement measures were obtained at different ages across the sample. Birth year and the age at which adult information was obtained were not related to IQ, which implies that sampling procedures were relatively constant across the study period. There were modest secular relationships for the educational and occupational ratings (for example, the more recently born obtained more years of schooling than did the early cohorts); but, when the variables were adjusted for differences in birth year and the age at which adult information was obtained, there was essentially no difference between the corrected correlations and those pictured in Fig. 1. Rarely did a correlation coefficient change by more than ± .03. Therefore, these data are consistent with Jencks's (*1*) conclusion that educational advances at the time of these studies had not closed the gap in success potential or constituted the "great equalizer" between advantaged and disadvantaged children.

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