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Social Factors associated with changes in Educational Attainment between 7 and 11 Years of Age

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Ample evidence now exists about the relationship between social factors and children's attainment at school. A number of studies, both nationally and locally based, have shown differences between children from different family sizes and social classes at a variety of stages in their school career. Much of the early work in this area is summarized by Floud, Halsey & Martin (1956) and Wiseman (1964); more recent perspectives are provided by Craft (1970) and Byrne *et al.* (1975).

The National Survey of Health and Development, a study of a sample of children born in one week of 1946, demonstrated differences associated with different family sizes and father's occupation on tests of reading vocabulary and intelligence at the age of eight and additionally in arithmetic at age eleven (Douglas, 1964). Furthermore these differences were found to persist through secondary school to the age of fifteen (Douglas, 1968).

Similar findings have emerged from the National Child Development Study whose subjects are all the children in England, Scotland and Wales born in one week in March, 1958. Data from this study have shown that, a decade after Douglas's findings, social class and family size are still associated with large differences in school attainment at the age of seven (Davie, Butler & Goldstein, 1972) and eleven (Fogelman, 1975).

A question which arises naturally from such findings is whether the differences between these groups change as the children progress through school. Do children of low social class and large families show a once and for all difference which is stable throughout their education or does the gap between them and their peers become wider or narrower?

Douglas (1964) did investigate this question by examining change in test performance between the ages of eight and eleven. Concerning social class he concluded that the average test scores made by children in four social classes differed more widely at 11 than they did at eight. However, with regard to family size, there was "no evidence that children from large families deteriorated in their test performance . . . (showing) that the influence of family size on the level of test score has exerted its full effect by eight years".

The purpose of the analyses reported here is to ascertain whether similar patterns are present for the period covered by the NCDS data, namely 1965 to 1969. In addition we have introduced a new factor into the analyses, that of changes in these variables between seven and eleven.

THE NATIONAL CHILD DEVELOPMENT STUDY

In 1958, a study was mounted of all children born in England, Scotland and Wales in the week 3rd–9th March of that year, the major purpose of which was to examine factors associated with

perinatal mortality (Butler & Alberman, 1969). The surviving children (with the addition of those born in the same week who entered this country after 1958), a cohort of some 16,000, were subsequently followed up at the ages of seven, eleven and sixteen.

At each of the first two follow-ups information was collected from a number of sources; schools administered attainment and ability tests and completed an assessment schedule; each child was examined by a local authority medical officer, and the parents (most commonly the mothers alone) were interviewed by a health visitor. The specific variables considered in this paper are as follows:

Seven-year-old data (1965)

Sex.

Social Class: the father's occupation was ascertained during the course of the parental interview. These occupations have been categorized according to the Registrar General's (1960) classifications of occupations into the following groups.

I Higher Professional
II Other professional and technical
III (Non-manual); other non-manual
III (Manual); Skilled manual
IV Semi-skilled manual
V Unskilled manual
No male head of household

In the analyses reported below the group with no male head of household (3% of the total sample) has been omitted, as have all adopted and illegitimate children.

Number of children in the household: during the course of the parental interview the total number of children under the age of 21 in the household was obtained, and has been subdivided into the number who are older and younger than the study child.

Reading attainment: as measured by the Southgate reading test (Southgate, 1962), a standardized test of word recognition.

Arithmetic attainment: as measured by a problem arithmetic test constructed for use in this study by the National Foundation for Educational Research (NFER).

Eleven-year-old data (1969)

Sex, Social Class and number of children in the household as at seven.

Reading attainment: as measured by a test constructed by the NFER to be parallel with the Watts-Vernon test of reading comprehension.

Mathematics attainment: as measured by a test constructed by the NFER for this study and combining a mixture of problems and mechanical items.

It should be noted that the reading and mathematics tests used at 7 and 11 are not the same with regard to the kinds of behaviour elicited. Thus we are in effect comparing one component of performance with another at the different ages. The 7 and 11 year reading scores have a correlation of 0·63 (0·66 after correction for attenuation), and the correlation for the 7 and 11 year mathematics scores is 0·56 (0·59 after correction).

Method of analysis

Douglas's (1964) findings mentioned above have been subject to certain statistical criticisms (Carter, 1964), based on his failure to take account of the 'measurement error', or unreliability, of the tests used when the children in the National Survey were aged eight. To take account of this we have formulated the problem in the following way.

Instead of attempting to measure change in score directly we explored whether for a given initial (i.e. at seven) test score the average scores at eleven are different for the various categories of social class and other variables considered. The advantage of this approach is that it avoids the problem of separately standardizing the two test score distributions and does not make the assumption that the simple difference in standardized scores is the most relevant aspect of change to measure. Since, in practice, the difference between final and initial score is usually not independent of the initial score, more information is provided by considering the detailed relationship between the two. Thus the problem has been formulated in terms of the linear regression relationship of eleven-year score on seven-year score (see Appendix).

Categorizations of variables used

The variable categories were chosen on the basis of previous evidence and on a preliminary exploration of the relationships within the present study. Thus the categories for older and younger children were chosen to provide as much detail as possible while retaining sufficient cell numbers for reliable estimates to be made. In the case of social class, previous evidence has suggested that the boundary between non-manual and skilled manual and that between semi-skilled and unskilled manual are both relatively more difficult for people to cross and coincide with marked changes in test scores. This was confirmed by our preliminary analysis of the relationship between 7 year and 11 year scores.

Presentation of results

Because it is desirable for results to indicate relative progress it has become conventional to relate test scores to their rate of increase with the reference group's age. We have therefore described the differences between groups in terms of 'years of reading (or mathematics) age'; and the axes on the figures are scaled in this way. These values must not be interpreted too rigidly however, since they are specific to the tests used and are strictly applicable only within a narrow range of ages.

For the eleven-year reading test the estimate for the Watts-Vernon test (Start & Wells, 1972) has been used, since the NCDS eleven-year reading test was derived from that test with very minor modifications which leave the distributional properties unaltered. For the mathematics test a sample of 239 children, some in their last year of primary school and some in their first year of secondary school, were given the test to provide an estimate of the mean change in score per year of age.

The estimate for the reading test is 2·2 points per year and for the mathematics test 4·5 points per year. Similar age-related scales are used for the seven-year tests and are reported in Davie *et al.* (1972).

Results

The findings of the first set of analyses are summarized in Table I. For each dependent variable (i.e. reading and mathematics score), analyses have been carried out fitting, in addition to seven-year test score, just one of the independent variables with which we are concerned (i.e. social class, sex or older and younger children in the household) and a fourth analysis fits all the independent variables simultaneously.

Social class

Fig. 1a depicts a clear separation of the social classes between the ages of seven and eleven in reading attainment and this is confirmed by the first analysis of variance summarized in Table I,

TABLE 1. Summary of analysis of variance findings (fitted constants; standard errors in brackets)

Independent variables	Categories	Dependent variable: 11-year Reading score in years (N=9374) (total variance=7·92)				11-year Mathematics score in years (N=9363) (total variance=5·19)			
Overall constant:		10·9	11·0	10·7	10·7	10·9	11·0	10·7	10·7
Seven-year score:	per year	0·8 (0·01)	0·9 (0·01)	0·8 (0·003)	0·8 (0·01)	0·6 (0·01)	0·7 (0·01)	0·7 (0·01)	0·6 (0·01)
Social class:	Non-manual	0·8			0·8	0·9			0·9
	III Man+IV	−0·2			−0·2	−0·2			−0·2
	V	−0·6			−0·5	−0·8			−0·7
Sex:	Boys-Girls		0·05		0·4 (0·04)		−0·0 (0·04)		0·0 (0·04)
No. of younger children:	0			0·4	0·4			0·3	0·2
	1			0·1	0·1			0·1	0·1
	2			−0·1	−0·1			−0·1	0·0
	3+			−0·4	−0·3			−0·4	−0·3
No. of older children:	0			0·4	0·4			0·5	0·4
	1			0·1	0·0			0·2	0·1
	2			−0·1	−0·1			−0·1	−0·1
	3+			−0·4	−0·3			−0·6	−0·4
Residual mean square:		4·52	4·71	4·61	4·39	3·26	3·56	3·43	3·19
	Interactions significant at 0·05 level	Social class × 7-year score**		No. of older children × 7-year score*	Social class × 7-year score*** Sex × 7-year score***		Sex × 7-year score*	No. of younger children × no. of older children***	Sex × 7-year score* No. of younger children × no. of older children** No. of younger children × social class*

Significance tests: In the main body of the Table, the independent variables are all significant at the 0·001 level apart from the sex differences in mathematics score, which are not significant at the 0·05 level.
For the interactions: $*P<0{\cdot}05$; $**P<0{\cdot}01$; $***P<0{\cdot}001$.

Additionally, interactions are present in the reading analysis, namely the regression lines for the social classes are not parallel. Fig. 2 shows the fitted regression lines, indicating a slight divergence of the lines with increasing 7-year score. It is difficult to draw particular inferences from this finding which are not related to the scale of measurement of the 11-year score. By a suitable non-linear monotone transformation of this scale it may be possible to eliminate this

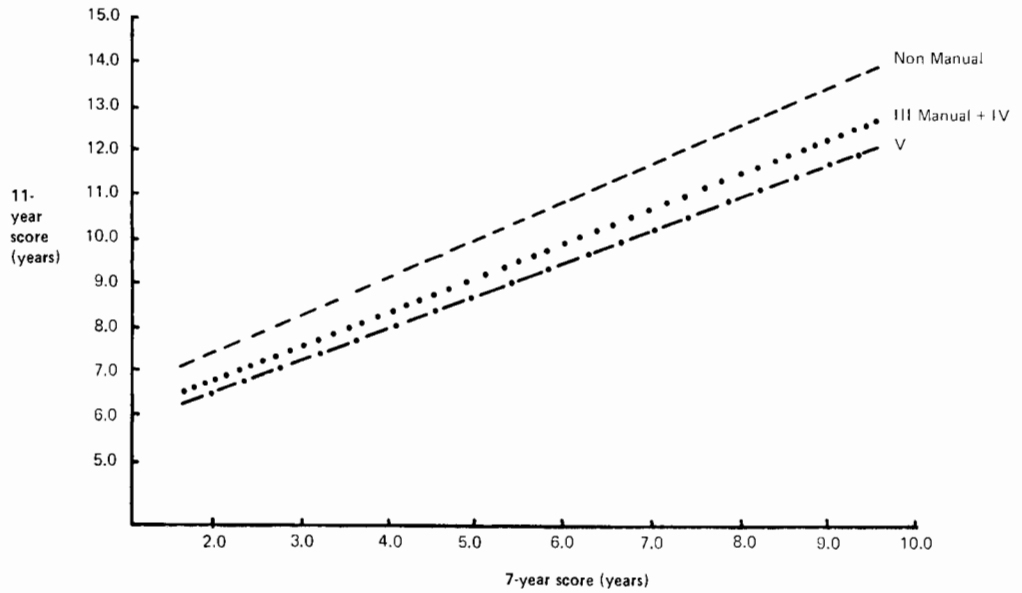

FIG. 2. Estimated regression of 11-year reading score on 7-year reading score for three social class groups at 7 years.

interaction, and since the choice of scale transformation will be arbitrary, at least with respect to psychological or educational considerations, this imposes a limitation on the kind of inference to be drawn. The fact that the observed eleven-year reading score for non-manual children is below that for III manual and IV for low 7-year scores, might suggest an important interaction, but the number of cases is too small to draw firm conclusions. What can be inferred from Figs. 2 and 1a however, is that for all 7-year scores there are approximately constant differences between the three social classes, and in particular that the ordering of these differences is unaffected by transformation (see Appendix). Where interactions occur in the following analyses they will be referred to only where their presence may have implications for any conclusions concerning such order relationships, but they are reported in the tables.

Sex

At the age of seven it was found that girls were significantly ahead of boys in their reading test scores. Fig. 3a and the analysis of variance show that for given 7-year scores the boys' average eleven-year score is 0·5 years ahead of the girls. The result of this is that there is no overall difference in reading attainment between boys and girls at eleven.

For mathematics, on the other hand, there is no average difference between the sexes in eleven-year score for given seven-year score. There is an indication of interaction, but any interaction effect that exists will be small and Fig. 3b presents no clear pattern. At the age of

For a given seven-year score the children whose fathers were in non-manual occupations are, at eleven, about 1·0 years ahead of social classes III manual and IV, who in turn are about 0·4 years ahead of social class V. This, of course, is additional to the pre-existing differences at the age of seven, which were respectively 0·9 years and 0·7 years (see Davie *et al.*, 1972). Thus, the overall differences at eleven have increased to 1·9 years and 1·1 years respectively.

A similar result is found for arithmetic (Fig. 1b), where the average difference associated with each seven-year score is 1·1 years between the non-manual and III manual and IV group, and 0·6 years between the latter and social class V.

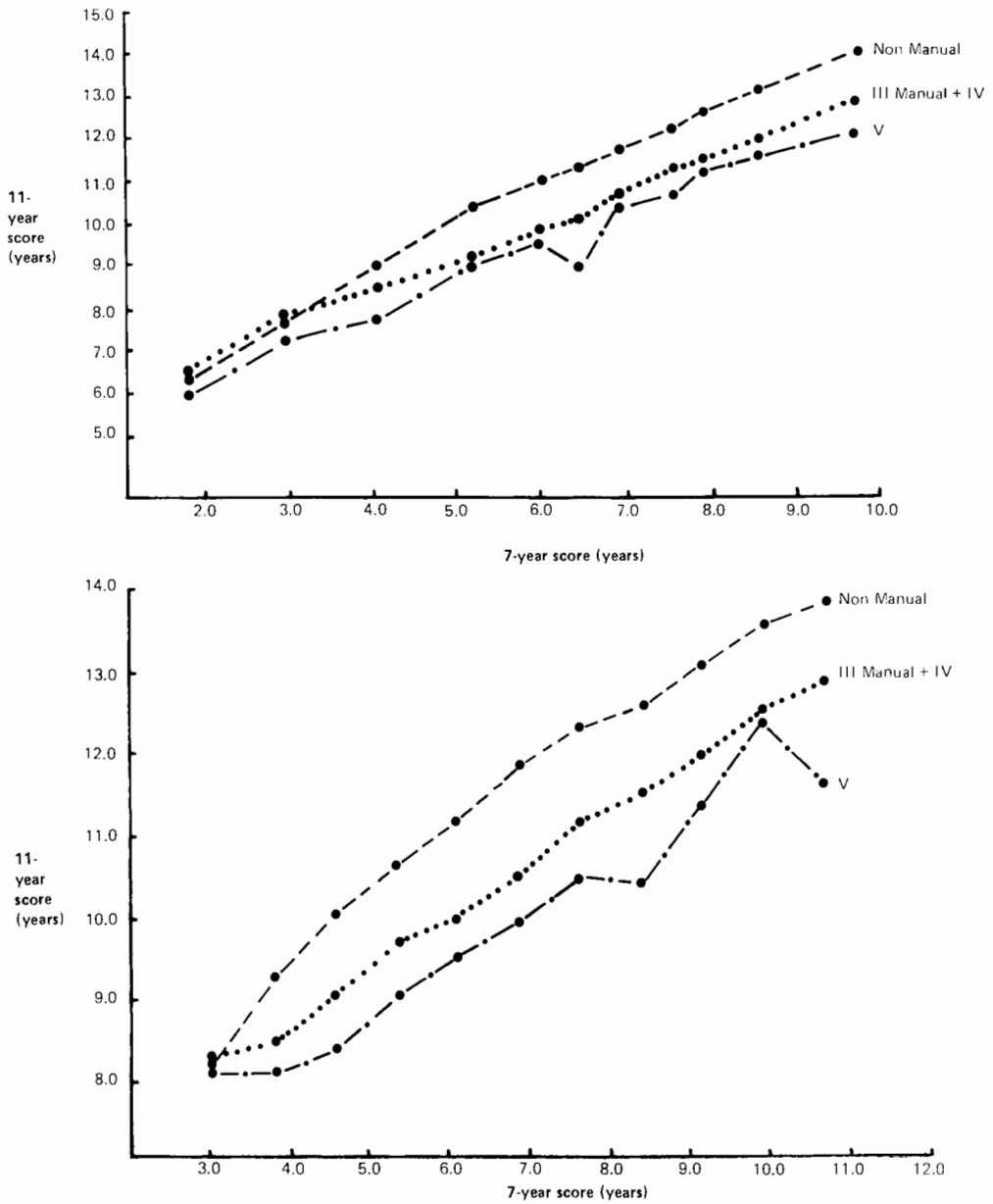

FIG. 1. (a) Mean 11-year reading score by 7-year reading score for three social class groups at 7 years. (b) Mean 11-year mathematics score by 7-year mathematics score for three social class groups at 7 years.

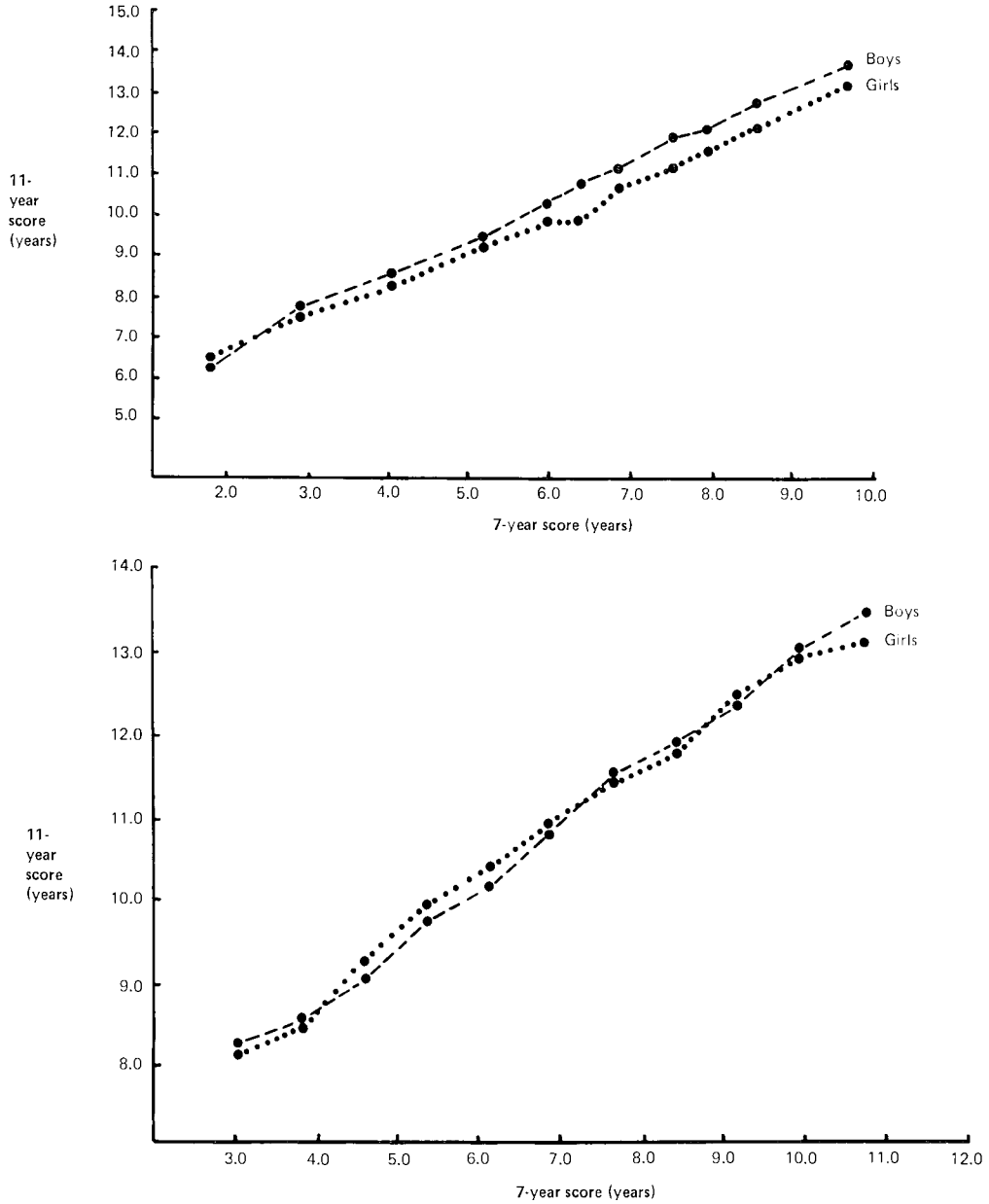

FIG. 3. (a) Mean 11-year reading score by 7-year reading score for each sex. (b) Mean 11-year mathematics score by 7-year mathematics score for each sex.

seven the boys were 0·2 years ahead of the girls and at the age of eleven the overall difference is 0·1 years. There is therefore no evidence of a change in the relatively small average difference between boys and girls.

Number of children in the household

Figs. 4a and 4b show the average eleven-year scores on the two tests for given seven-year scores for different total numbers of children in the child's household at the age of seven. For both

reading and mathematics the greater the number of children in the household the lower is the mean eleven-year score for given seven-year score.

The total number of children in the household can be subdivided into those older than the study child and those younger. This provides more detailed information than studying only the total number of children.

The analyses in Table I present the results of jointly fitting these two variables and seven-year score. For a given seven-year reading score the difference at eleven between having no younger children in the household at the age of seven and having three or more is about 0·8 years. The corresponding difference for older children is almost identical. When these figures are combined

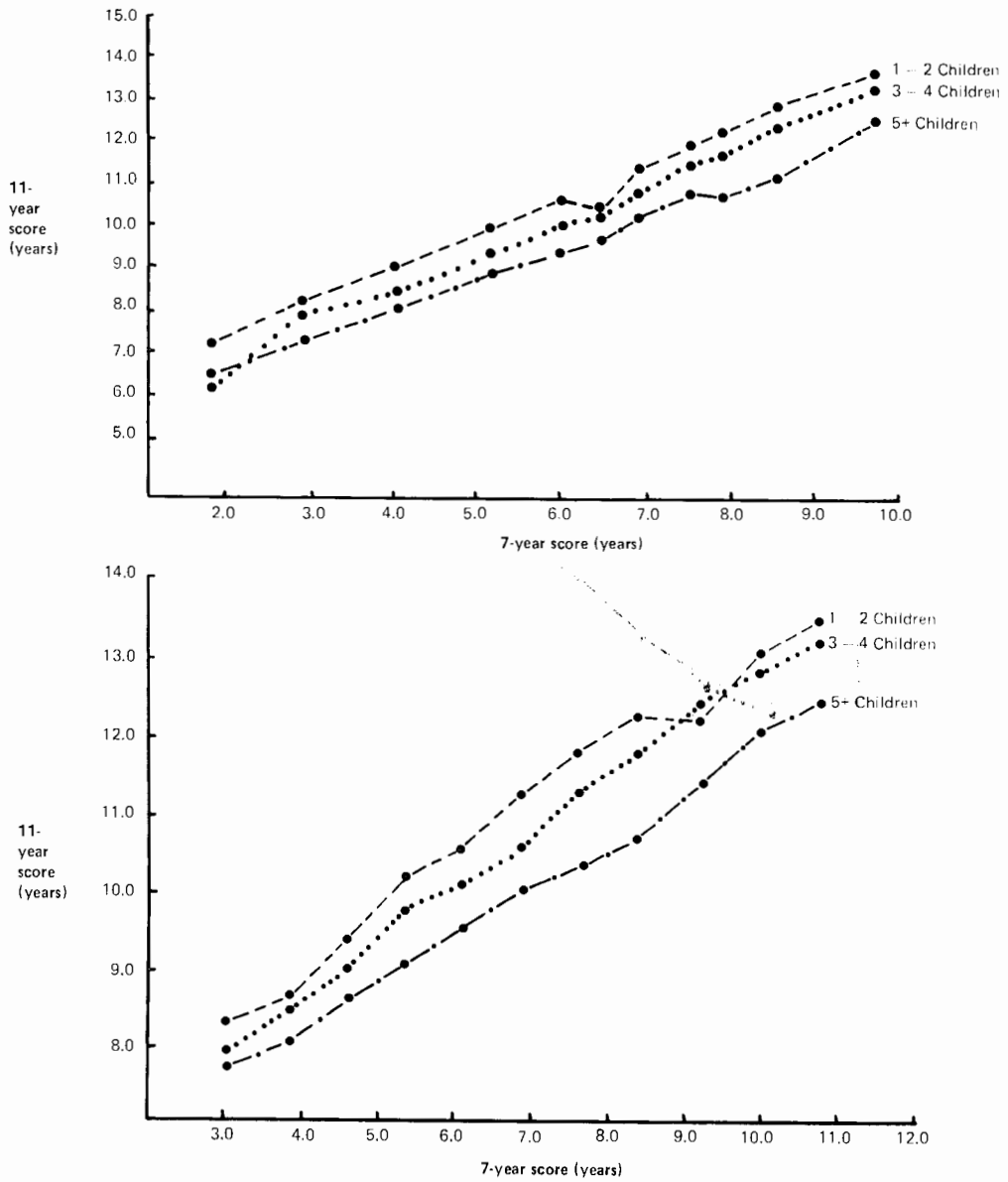

FIG. 4. (a) Mean 11-year reading score by 7-year reading score for three 'number of children in household' groups. (b) Mean 11-year mathematics score by 7-year mathematics score for three 'number of children in household' groups.

with the pre-existing differences at the age of seven, we find at eleven a difference of 1·6 years between no younger children and three or more, and correspondingly of 1·8 years for older children.

In mathematics those children with no younger children in the household have moved 0·7 years ahead of those children with three or more younger children in the household and who had the same scores at seven. The difference associated with older children in the household amounts to 1·0 years. The overall differences at eleven for these two variables are 0·9 years for younger children and 1·2 years for older children in the household.

It will be seen however, that for mathematics, but not for reading, there is a highly significant interaction between older and younger children; namely that children who at seven are the only child in the household have a lower 11-year score than those in households where there is just one older or younger child. Whilst of some interest, this interaction is not directly relevant to the main theme of the present paper and we can ignore it in the discussion of the following analyses. We note however, that it is still present in the more extensive analyses although smaller in size.

Joint effects

Two of the variables considered—social class and the number of children in the household—are not independent of each other. For example, when these children were seven the proportion of non-manual households with only one child was 8·8% whereas the proportion in social class V was 5·7% (Davie *et al., op cit*). It is therefore of interest to study the joint and partial effects of these variables and sex on the eleven-year-old scores.

The fitted constants do not differ substantially from those in the separate analyses, although the contrasts between categories are somewhat reduced. Since the effects are additive we can estimate differences between combinations of categories. To take an extreme contrast, a child from a non-manual home with no older or younger children in the household at the age of seven, is, at the age of eleven, about 2·7 years ahead in reading of the child who obtained the same score at seven but is from social class V and has 3 or more older and younger children in the household. However, this contrast involves only 2·3% of all children and has an approximate 95% confidence interval from 2·4 to 3·0 years. Furthermore, we should be particularly cautious about interpreting such large differences as being accurate estimates of average differences in attainment between two given ages, since the age-score relationship may be markedly non-linear over a wide age-range.

Changes in home variables

Changes in social class, across the combinations of categories which we have employed, are summarized in Table II. From this we see that for about 16% of children the social class had changed, the largest group being the 6·3% whose fathers had moved from occupations in the III manual and IV group to non-manual occupations.

Changes in household size are shown in Tables III and IV. At least 17% of the children had at least one extra younger child entering the household between seven and eleven and about 13% had one less older child in the household by eleven. Because of our definition of children this last figure will be explained mainly by those siblings who reach the age of 21 between the two follow-ups.

We have included these changes as additional variables in the analyses of variance, the results of which are shown in Table V. There are two reasons for utilizing the 11-year information by adding a measure of change rather than including the same variable measured at eleven years. Firstly, we are interested in the changes themselves and it is natural to specify them directly in the analyses. Secondly, the high association between the seven- and eleven-year variables could result in some instability in the fitted constants.

TABLE II. Social class at 7 by social class at 11 (children with both natural parents). (Percentages on table total in brackets)

		Social class at 11			
		Non-manual	III Manual + IV	V	Total
Social class at 7	Non-manual	2958 (27·3)	346 (3·2)	15 (0·1)	3349 (30·9)
	III Manual + IV	686 (6·3)	5867 (54·1)	270 (2·5)	6823 (62·9)
	V	20 (0·2)	343 (3·2)	317 (2·9)	680 (6·3)
	Total	3694 (34·0)	6556 (60·4)	602 (5·6)	10852 (100·0)

TABLE III. Number of younger children at 7 by younger children at 11 (children with both natural parents). (Percentages on table total in brackets)

		Younger children at 11				
		0	1	2	3+	Total
Younger children at 7	0	4275 (34·7)	590 (4·8)	68 (0·6)	20 (0·2)	4953 (40·3)
	1	85 (0·7)	3421 (27·8)	695 (5·6)	127 (1·0)	4328 (35·2)
	2	15 (0·1)	39 (0·3)	1424 (11·6)	537 (4·4)	2015 (16·4)
	3+	7 (0·1)	7 (0·1)	32 (0·3)	962 (7·8)	1008 (8·2)
	Total	4382 (35·6)	4057 (33·0)	2219 (18·0)	1646 (13·4r)	12304 (100·0)

For younger children, we have excluded those cases where there was a recorded decrease (1·6% of all cases), since these are likely to be, in part, errors in recording. Similarly we have excluded cases where an increase in older children has been recorded (0·9%). Turning to the results, we find that the addition of the change variable slightly reduces the differences between the categories of the seven-year variables. There are also comparatively large differences associated with the changes. In the case of social class, those moving from non-manual to skilled or semi-skilled groups had an average 11-year reading score 0·6 years behind those who stayed in the non-manual group for given seven-year score. By contrast, those who moved in the other direction, from social class III manual or IV into the non-manual group, were 0·5 years ahead in reading of those whose fathers remained in skilled or semi-skilled occupations. In the case of

TABLE IV. Number of older children at 7 by older children at 11 (children with both natural parents). (Percentages on table total in brackets)

		Older children at 11					
		0	1	2	3	4+	Total
Older children at 7	0	4082 (37·0)	45 (0·4)	4 (0·0)	2 (0·0)	0 (0·0)	4133 (37·5)
		310 (2·8)	3401 (30·8)	23 (0·2)	5 (0·1)	1 (0·0)	3740 (33·9)
	2	99 (0·9)	385 (3·5)	1224 (11·1)	5 (0·1)	2 (0·0)	1715 (15·6)
	3	27 (0·2)	102 (0·9)	235 (2·1)	446 (4·0)	6 (0·1)	816 (7·4)
	4+	6 (0·1)	25 (0·2)	111 (1·0)	166 (1·5)	320 (2·9)	628 (5·7)
	Total	4524 (41·0)	3958 (35·9)	1597 (14·5)	624 (5·7)	329 (3·0)	11032 (100·0)

other children in the household the difference between having no further younger children in the household and having two or more was, though significant, small, being 0·4 years. Those children where two or more older children had moved out of the household were, by eleven, just 0·2 years ahead of those with the same number of older children at the two ages.

Arithmetic scores show a similar pattern. Those moving from the skilled and semi-skilled groups to the non-manual group show a gain of 0·5 years compared with those whose social class has not changed, and a move in the other direction is associated with a loss of 0·6 years. The effects of a change in the number of children in the household was small, an increase of two or more younger children being accompanied by a loss of 0·3 years and the difference associated with a decrease of two or more children failed to reach statistical significance.

DISCUSSION

The National Survey children (Douglas, 1964) were eleven years old in 1957. Our data, 12 years later, confirm Douglas's findings on social class and additionally show that family size exhibits a changing association with attainment test scores between the ages of seven and eleven. We have also shown that social mobility and increase in family size influence test scores in the expected directions. Further analysis of the NCDS data will help to refine these conclusions—other social factors are known to be associated with educational attainment, for example parents' education and age (Davie *et al.*, 1972), and the present findings represent only the first stage of a detailed investigation. It should also be remembered that we have dealt with only two points in time, and what we have found may reasonably be regarded as a reflection of differing rates of development.

It is not the purpose of the present paper to pursue in detail any theoretical explanations for our findings, but one or two points are worth noting.

TABLE V. Summary of analysis of variance findings (fitted constants; standard errors in brackets)

Independent variables	Categories	Dependent variable: 11-year Reading score in years (N=9374) (total variance=7·92)	Dependent variable: 11-year Mathematics score in years (N=9363) (total variance=5·19)
Overall constant:		10·7	10·5
Seven year score:	per year	0·8 (0·01)	0·6 (0·01)
Social class at 7:	Non-manual	0·8	0·9
	III Man.+IV	−0·3	−0·2
	V	−0·6	−0·7
Change in social class between 7 and 11:	At 7 / At 11		
	V / I—IV	0·0	0·0
	III Man.+IV / Non-man.	0·5	0·5
	I—IV / V	−0·6	−0·5
	Non-man. / III Man.+IV	−0·7	−0·6
	No change	0·0	0·0
Sex:	Boys-Girls	0·4 (0·04)	0·0 (0·04)
No. of younger children at 7:	0	0·3	0·2
	1	0·1	0·1
	2	−0·1	0·0
	3+	−0·3	−0·2
Increase in younger children between 7 and 11:	0	0·2	0·2
	1	−0·1	0·0
	2+	−0·1	−0·2
No. of older children at 7:	0	0·4	0·3
	1	0·0	0·1
	2	−0·1	−0·1
	3+	−0·4	−0·4
Decrease in older children between 7 and 11:	0	−0·2	0·1
	1	0·2	0·0
	2+	0·0	−0·1
Residual mean square:		4·34	3·15
	Interactions significant at 0·05 level	Social class × 7-year score ***	Sex × 7-year score *
		No. of older children × 7-year score*	Younger children × older children***
		Sex × 7-year score**	Social class × younger children**

Significance tests: In the main body of the table, the independent variables are all significant at the 0·001 level, apart from sex and decrease in older children on the mathematics test, which are not significant at the 0·05 level.

For the interactions: $*P<0·05$; $**P<0·01$; $***P<0·001$.

With regard to the family size results, we need to be cautious in making comparisons between older and younger children since we know only the number of such children and not their ages. It is clear however, that the greater the number of older or younger children in a child's household, the worse becomes the attainment of that child, and this is so after allowance has been made for social class. Furthermore, where older children 'leave' the household by passing the age of 21, and where there are no further younger children entering, there is a relative gain in attainment. This in part may reflect the effect of a longer spacing interval between the study child and other children in these households.

In the case of social class we find that in addition to the well-known difference between the children of manual and non-manual groups, those from 'upwardly' mobile families improve their attainment scores relative to those from static families, who in turn improve relative to those from 'downwardly' mobile families. The twelve years which separate the results of the National Survey and those of the present study have seen an increased apparent egalitarianism in educational provision, despite which this effect still appears.

Finally, we would like to stress that we are measuring the average differences which actually exist among children, and straightforward cause-effect relationships cannot be deduced from these alone.

SUMMARY

Using data from the National Child Development Study, changes are examined in reading and mathematics attainment between the ages of seven and eleven years, for children from different social classes and family sizes. It is found that, for any given seven-year attainment, these variables and changes in them are associated with different eleven-year attainments.

We acknowledge with thanks the contributions made by past and present staff of the National Children's Bureau to all stages of these analyses and in particular the help of Dr K. Richardson. We are grateful to Mr M. J. R. Healy for his helpful comments and thank the staff of the National Foundation for Educational Research for their help with tests. This research was financed by grants from the Department of Education and Science, the Department of Health and Social Security and the Social Science Research Council. We also gratefully acknowledge the support of the National Institute of Education (Washington D.C.).

APPENDIX

Transformations of test scores

The relationship between mean 11-year mathematics score and 7-year arithmetic score is adequately described by a straight line, whereas that for reading becomes markedly non-linear for high seven-year scores. This, at least in part, reflects the fact that the 7-year reading test discriminated poorly between good readers and resulted in nearly one-third of children obtaining the top scores of 29 and 30. In order to simplify the analysis, the scale of the 7-year reading score has therefore been transformed to give an approximately linear relationship as in Fig. 1a. This Figure and Fig. 1b also show that the relationship remains linear within social class groups, and this is also true for the categories of the other variables used in the analyses. The scales for the test scores are expressed in years, obtained by dividing each score by an estimate of the average change in score over a period of one year (see Goldstein & Fogelman, 1974).

It is a common practice to transform the distribution of 'raw' scores on mental tests to a Gaussian distribution. The distributions of the 11-year test scores have been studied within

categories of social class and older and younger children and found to have near Gaussian distributions without transformation. We have studied variance stabilizing transformations and have found no discernible improvement over the use of raw scores. We have therefore not carried out transformations for either of these two purposes. A third reason for transforming the dependent variate is to simplify the mathematical model. Although we have produced approximate linearity of regression through the transformation of the 7-year score in the case of reading, there is still the possibility of interactions occurring which could possibly be eliminated or substantially altered by a change of 11-year scale. For given 7-year scores we have compared the distributions of 11-year scores between categories of each variable used. If these distributions were to have different shapes then it might be possible to find a non-linear but monotone transformation of the variable which would alter the relative ordering of the mean values of the three categories, and correspondingly alter our inferences. We find however, that the distributions approximate closely to a Gaussian distribution and differ only in respect of their mean values. Similar results hold for the other 7-year variables and for the mathematics test scores. We can accept therefore that our inferences about order relationships between location parameters will be unchanged under monotone transformation, although of course the relative differences between means may alter.

Measurement error

It is a well known result in simple linear regression (see e.g. Kendall & Stuart, 1961) that the presence of 'measurement error' in the independent variable leads to inconsistency in the estimation of the regression slope, namely that the expected value of the observed slope is always too small. In the present case, one of the independent variables, the 7-year score, is measured with error and we must make appropriate adjustments to obtain consistent estimates of the fitted constants in the linear models.

The reported reliability of the 7-year reading test (Southgate, 1962) is 0·95. Since the transformation may have reduced this value, we have carried out our analyses using values of 0·90 and 0·80. No estimate for the 7-year mathematics test is available and we have also tried values of 0·90 and 0·80. We have studied the effect of correcting for measurement error by subtracting the variance of the 'errors' thus obtained (assuming independence of the measurement error and the other independent variables) from the variance of the 7-year score in the variance-covariance matrices of independent variables used in the analyses. This provides an unbiased estimator of the population covariance matrix involving the true variable, and leads to consistent estimates of coefficients and tests of significance, which, because of the large sample size, are ensured of a negligible bias (see Warren *et al.*, 1974).

This procedure, when carried out for the reliability values of 0·80 and 0·90 had little effect on the estimates and inferences. It is not until the reliability falls below about 0·6 that marked differences occur, for example the differences between the social class groups approach zero. Hence, for simplicity, in the text all the basic findings are presented in terms of uncorrected observed scores. (Further details of these analyses can be obtained from the authors.)

In the tables we present fitted constants and significance tests for the variables in the linear models. For particular contrasts between variable categories and combinations of categories the standard errors may be relatively large. There are very many possible contrasts however, and we present standard errors only for two-category and continuous variables, apart from one case in the text involving a contrast between category combinations involving small extreme groups.

REFERENCES

BUTLER, N. R. & ALBERMAN, E. D. (1969), *Perinatal Problems* (Edinburgh, Livingstone).
BYRNE, D., WILLIAMSON, B. & FLETCHER, B. (1975), *The Poverty of Education* (London, Martin Robertson).

CARTER, C. O. (1964), Review of the home and the school. *Eugenics Review*, 56, 2, 93.
CRAFT, M. (1970), *Family, Class and Education* (London, Longman).
DAVIE, R., BUTLER, N. R. & GOLDSTEIN, H. (1972), *From Birth to Seven* (London, Longman).
DOUGLAS, J. W. B. (1964), *The Home and the School* (London, McGibbon & Kee).
DOUGLAS, J. W. B., ROSS, M. & SIMPSON, H. R. (1968), *All our Future* (London, Peter Davies).
FLOUD, J., HALSEY, A. H. & MARTIN, F. M. (Eds.) (1956), *Education, Economy and Society* (London, Heinemann).
FOGELMAN, K. R. (1975), Developmental correlates of family size. *British Journal of Social Work*, 5, 1.
GOLDSTEIN, H. & FOGELMAN, K. R. (1974), Age standardisation and seasonal effects in mental testing. *British Journal Educational Psychology*, 44, 2, 109.
KENDALL, M. G. & STUART, A. (1961), *The Advanced Theory of Statistics*. Vol. II, Chap. 29 (London, Griffin).
REGISTRAR GENERAL (1960), *Classification of Occupations* (London, H.M.S.O.).
SOUTHGATE, V. (1962), *Southgate Group Reading Tests: Manual of instructions* (University of London Press).
START, K. B. & WELLS, B. K. (1972), *The Trend of Reading Standards* (Slough, NFER).
WARREN, R. D., WHITE, J. K. & FULLER, W. A. (1974), An errors-in-variables analysis of managerial role performance. *Journal of the American Statistical Association*, 69, 886.
WISEMAN, S. (Ed.) (1964), *Environment and Education* (Harmondsworth, Penguin).