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INTELLIGENCE AND SOCIAL MOBILITY

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The main thesis of the following paper is that, in a highly organized society, the discrepancies between the general intelligence of the children and the occupational class into which they are born is bound to produce a large and fairly constant amount of ' basic mobility ', quite apart from any deliberate changes in the political or educational structure of the society.

Since the correlation between the intelligence of fathers and sons is only about 0·50, it is evident that, when classified according to their occupational status, (i) the mean intelligence of the children belonging to each class will exhibit a marked regression towards the general mean, and (ii) the intelligence of the individual children within each class will vary over a far wider range than that of their fathers. These deductions are fully confirmed by tables compiled to show the actual distribution of intelligence among adults and children belonging to the various occupational categories. It follows that, if the frequency distribution within the several classes is to remain constant (and still more if there is to be an increasing degree of vocational adjustment among later generations), a considerable amount of social mobility must inevitably take place, involving between 20 and 30 per cent of the population. Approximate estimates are attempted of both the actual and the ideal amounts. Data obtained from the after-histories of schoolchildren, followed up in later life, are analysed to ascertain the main psychological causes tending to produce a rise or drop in occupational status.

1. THE CLASS DISTRIBUTION OF INTELLIGENCE

Aim. In the course of a recent discussion on the mental differences between social classes [19, 20, 21] I argued that the apparent differences between the class-means for general intelligence were to be explained partly by the effects of social mobility in transferring abler individuals from lower classes to higher and duller individuals from higher classes to lower, and partly by the manner in which inherited or innate differences are transmitted from one generation to another. Several sociological writers, however, have questioned both these suggestions, or at any rate the way in which I assumed the two processes had actually operated. In this paper, therefore, I propose to offer more detailed evidence to support the interpretations I put forward, and at the same time to answer, so far as I can, the various objections raised against the arguments which I advanced on these various points ([19], pp. 22f, section on ' Social Mobility ').

The data which I shall analyse are drawn from two overlapping inquiries, or rather two series of inquiries: (i) cross-sectional surveys of pupils in London schools, initiated primarily for the purposes of educational or vocational guidance

and selection; (ii) longitudinal studies of backward, gifted, and normal pupils, followed up into adult life chiefly to check the accuracy of the assessments and recommendations made while the children were still at school [4, 26]. The surveys and the subsequent inquiries were carried out at intervals over a period of nearly fifty years, namely, from 1913 onwards; and much of the data is due to the willing cooperation of numerous collaborators, particularly teachers and social workers in the service of the London County Council and colleagues or senior research-students working for the National Institute of Industrial Psychology, to all of whom I am deeply indebted.

Points of Agreement. It may help to clarify the issues involved if I begin by summarizing the major points on which both my critics and myself would, I fancy, be in general agreement.

1. During the period covered by our inquiries the population, from which our samples are drawn, and to which we intend our conclusions to apply, greatly increased in numbers, though at a diminishing rate. Both the increase itself and the diminution in the rate of increase were a continuation of processes that had been going on during the preceding half-century. Thus in 1860 the total population of England and Wales was nearly 20 million; in 1910 it was almost twice as large—36 million; and in 1960 it was 45 million [10, 11, 24].

2. During the last half-century the proportional number of children in the population steadily declined and that of the elderly steadily increased. In 1910 31 per cent of the population were boys and girls of school age (i.e. under 15) and 7 per cent men or women over 60; in 1960 only 22 per cent were of school age and 14 per cent over 60.

3. Among the lower working classes (unskilled manual labourers) both the birthrate and the deathrate were appreciably higher than among the semi-skilled, skilled, or professional classes. The number of live births per married woman averaged about 3·8 among unskilled labourers and only 1·8 in the professional classes. The differences in the mortality rates were much smaller, averaging 13·1 per 1000 among the unskilled labourers and only 10·8 per 1000 in the professional classes. For birth and death alike the absolute rates and the class differences have both appreciably diminished during the period in question. The excess of birthrate over the deathrate has been by far the most important cause of the increase in the population [11, 24].

4. During the period for which information is available there has been no great change in the average level of general intelligence. The results of the second Scottish survey indicated an actual improvement in the average score with the tests employed [7]; but I myself believe, as Sir Godfrey Thomson suggested in his preface to the report, that this was an artificial and somewhat misleading result, due partly to increased familiarity with the tests and methods of testing [8]. On the whole, a survey of the relevant evidence would appear to suggest an actual but comparatively slight decline during the period in question, approximating to a drop of 1 or 2 I.Q. points per generation [5].

5. The amount of individual variation about the average level of intelligence has apparently remained fairly constant; certainly it has not declined [6, 16]. When we compare the printed tables giving the standard deviations for complete age-groups, we usually find that in the earlier surveys it is about 12 or 13 I.Q. points and in the later as much as 16 or even more. But the apparent increase is in all probability to be explained by the fact that the later test-scales are greatly improved, and as a result decidedly more discriminative. Where the same tests have been used the figures show no appreciable change.

6. There are appreciable differences in the average level of intelligence in the different socio-economic classes, and in spite of the remarkable improvements in material and cultural conditions, the differences have altered hardly at all during the period in question [1, 3, 16].

On all these points further research and more exact information is undoubtedly required. But I believe that, as a rough provisional statement, what I have said would be accepted by most social psychologists.

Points of Disagreement. The issues on which disagreement has been most strongly expressed are those relating to the genetic hypothesis. Dr. Floud and Dr. Halsey, for example, deny that the apparent differences between the class-means for general intelligence are in any degree due to innate differences; and both contend instead for " a hypothesis of near-randomness in the social distribution of innate intelligence ". This implies that the means for all the classes would be approximately the same. Many of their colleagues have also argued that even " the apparent differences in intelligence between individuals, whether adults or children, result not from genetic causes but solely or mainly from environmental conditions ". Dr. Halsey, however, is prepared to admit that individuals may vary in innate ability; but the model he has put forward to explain how such differences are in his view transmitted and redistributed diverges widely from mine [21]. In particular he criticizes both the amount of social mobility which I had assumed and the length of time over which I assumed it had operated; his view, like that of many other social writers[1], apparently supposes that social mobility is a comparatively late phenomenon, the result more especially of recent social and educational reforms.

II. Alternative Methods of Analysis

Correlational Analysis and Variance Analysis. Many of the foregoing criticisms arise, I fancy, very largely from the fact that the method which I adopted in the investigations cited differed considerably from those adopted for psychological researches on heredity in the past. Most psychologists have discussed the problems of genetics in terms of the correlational procedures popularized by Karl Pearson; the investigations of my coworkers and myself were based mainly on an analysis of variance using the techniques applied by Ronald

[1] Most of them ignore genetic influences altogether: see the interesting papers in *Population Studies*, IX, pp. 72–81, 82–95, XI, pp. 123–136, 262–8.

Fisher. Unfortunately such methods still seem unfamiliar to the majority of psychologists and sociologists working in this country.

The analysis of variance has numerous merits with which statistical investigators are already well acquainted; but in the field of genetics it has one special advantage over the older correlational techniques. In nearly all the earlier statistical studies heredity itself was commonly conceived as 'the tendency of like to beget like'; hence the correlation coefficient, as a measure of likeness, seemed the obvious tool. On the Mendelian theory, however, genetic influences are responsible, not only for resemblances between members of the same family, but also for differences, i.e. for individual variations. Genetic variability within families receives little or no attention from those psychological critics who still accept the Pearsonian view, and think mainly in terms of correlations; yet, as we shall see in a moment, variability within families forms one of the chief causes of mobility. Moreover, it was to a large extent the exclusive reliance on correlational analysis which was responsible for the abnormally low estimates which Pearson and his followers reached for the influence of environment. Variance techniques make it far easier to give due weight to environmental influences, and to the further complications which result from the fact that environment and heredity so often work in the same direction.

In the present paper I shall, so far as possible, avoid unfamiliar methods and formulae. Nevertheless, because I believe that researches undertaken in the near future should be deliberately planned to permit the application of these newer and more efficient techniques, I will first attempt a brief explanation of the type of procedure that would seem most appropriate, and at the same time indicate how it is related to the more familiar correlational procedures. This may to some extent help to elucidate several of the points in my recent paper which the critics have either questioned or misunderstood.

The Factorial Analysis of Variance. Let us start, rather on the lines of Fisher (*op. cit. inf.*, pp. 210f.), with the simplest type of situation—that in which only two independent components of variance are involved. To make the problem concrete let us consider the case of n identical twins, reared in different environments, and tested or assessed for some form of educational or occupational efficiency, which we may plausibly suppose to be the result of both genetic (g) and environmental factors (e). If x_i denotes the assessment for the ith individual, r a correlation coefficient, and s^2 an estimated variance, we may write

$$x_i = g_i + e_i \qquad (i = 1, 2 \ldots n) \qquad \text{(i)}$$

Squaring and summing we obtain

$$\Sigma x^2{}_i = \Sigma g^2{}_i + 2\Sigma g_i e_i + \Sigma e_1{}^2,$$

$$\text{and therefore } s^2{}_x = s^2{}_g + 2r_{ge}s_g s_e + s^2{}_e,$$

$$\text{or } s^2{}_x = s^2{}_g + s^2{}_e, \qquad \text{(ii)}$$

if it can be assumed that the foster-homes have been chosen in a way quite unrelated to the intellectual level of each child's own family.

If we adopt a correlational procedure, the appropriate coefficient will be the *intra-class* correlation. Accordingly, following Fisher (with a slight change of notation) let us put

$$r_{it} = \frac{G}{G+E}, \qquad \text{(iii)}$$

where G and E denote the genetic and environmental variances respectively. Now, as Fisher shows, we can obtain an unbiased estimate of r_{it} from the two equations

$$n(1-r)s^2_x = \Sigma(x_i - \bar{x}_j)^2 = ns^2_w, \qquad (i = 1, 2 \ldots 2n) \qquad \text{(iv)}$$

$$(n-1)\,(1+r)s^2_x = 2\Sigma(\bar{x}_j - \bar{x})^2 = (n-1)s^2_b, \qquad (j = 1, 2 \ldots n) \qquad \text{(v)}$$

where x_i (as before) denotes the assessment of the ith individual, $\bar{x}_j$ the mean of the family to which that individual belongs, s^2_x the estimated total variance, s^2_w the variance ' within families ', and s^2_b the variance ' between families ', n the number of families, and $2n$ therefore the number of twins, and r the correlation between the twins' intelligence[1].

To estimate the relative size of the contributions of G and E, however, we need two further equations. Fisher shows in the course of his discussion that

$$\sum^{mn}(x - \bar{x}_j)^2 = n(m-1)E, \qquad \text{(vi)}$$

$$\text{and } \sum^{n}(\bar{x}_j - \bar{x})^2/(n-1) = G + E/m, \qquad \text{(vii)}$$

where m is the number in each family (with twins $m = 2$). Substituting from (iv) and (v), and then solving for $G = s^2_g$ and $E = s^2_e$, we obtain

$$G = \tfrac{1}{2}(s^2_b - s^2_w), \qquad \text{(viii)}$$

$$E = s^2_b. \qquad \text{(ix)}$$

These then are the equations we require; and I have ventured to call the whole procedure the ' factorial analysis of variance '.[2] On substituting in equation (iii) from equations (viii) and (ix) we have for the coefficient of correlation

$$r_{it} = \frac{s^2_b - s^2_w}{s^2_b + s^2_w}, \qquad \text{(x)}$$

which sums up the relation between the results of the two alternative procedures —correlation and analysis of variance—in the simplest conceivable case.

In the foregoing problem—that of identical twins brought up in separate homes—both the variance within the family due to genetic influences and the effects of environment so far as it operates in the same direction as the genetic influences could be safely ignored. If we wish to estimate the former, we can

[1] Fisher, *Statistical Methods for Research Workers* (5th ed., 1934, chapter VII, ' Intra-Class Correlation and Analysis of Variance '. The formula for r is given on p. 212, and the equations for the sum of squares ' within families ' and ' between families ' will be those given in Table 39 not Table 38: cf. also [4], pp. 675f. and [14], pp. 106f.

[2] This type of analysis has wide applications in psychometrics, and may also be extended to the study of interactions: see, for example, this *Journal*, VIII, p. 116.

take ordinary siblings brought up from birth in the *same* environment, e.g. orphanages and other residential institutions (cf. [3], pp. 90–91); and if we want to determine the effects of any correlation between environment and heredity, we can either reintroduce the correlational term r_{ge} or calculate the additional variance directly by the method described in the earlier paper [14].

Multiple Cross-Classifications. To deal with more complex situations the foregoing techniques can readily be extended to problems involving a multi-dimensional classification. In such cases, it may be noted, both the algebraic solutions and the arithmetical calculations become much simpler if the successive classifications are dichotomous. Thus, in dealing with genetical problems, it would certainly be desirable to take into account temperamental and motivational tendencies (m) as well as cognitive abilities (a). Since a general factor underlies each, we may for most purposes, treat each as supplying the basis for a further two-fold classification. In studying the influence of social class we must cross-classify both the genetic factors and the environmental according to the variations in family (f) and in social class (c): this would mean that our simple dichotomous equation (equation (i) above) must now be rewritten

$$x = g_c + g_f + e_c + e_f, \qquad \text{(xi)}$$

and, if we wish to include motivational factors as well as cognitive, we must be prepared to work with eight variables, g_{ac}, g_{mc}, g_{af}, etc. In either case the derivation of the formulae will proceed much as before. But, by deciding in advance which variables we will include and which we will exclude (e.g. by arranging to keep certain conditions constant) and by avoiding so far as possible interactions or intercorrelations between the variables retained, many of the complications may be eliminated or at least reduced to insignificance.

Incidentally, we may note that with an analysis of variance it is not necessary (as it would be with a correlational procedure) to assume that the social classes themselves must be expressed by measurable quantities (e.g. by income) or ranked in linear order (e.g. in terms of prestige), as in fact has been the custom in many sociological inquiries. The method thus avoids the difficulty experienced by investigators of mobility who have endeavoured to assess or rank rural occupations on the same scale as urban and industrial[1]. The calculations would become simpler still if we were content, with several recent investigators (Lipset and Bendix [23], for example), to reduce the occupational classification in either case to a twofold division, namely, manual and non-manual.

[1] Glass [13], for example, in his study of social mobility in Britain, attempts to classify urban and rural populations together, and in this he is followed by L. Livi and K. Svalastoga in Italy and Denmark respectively—agricultural countries where a unidimensional classification of this kind ceases to be plausible [9]. Most other investigators classify the urban and the rural populations separately [15, 17, 18]. Even in the case of urban occupations much of the data available is expressed in terms of occupational categories which it would be very difficult to rank; in such cases, therefore, the analysis of variance, or (if Pearsonian techniques are preferred) the calculation of contingency coefficients, is far more appropriate than the calculation of correlations.

In principle, therefore, the questions with which we are concerned are essentially problems in multivariate analysis. Multivariate analysis can take several forms; and, according to the specific nature of the question we wish to answer, we may use either factor analysis, regression analysis, or discriminant analysis. But, once again, in any future research it is desirable that the investigator should keep explicitly in mind from the outset the kind of statistical techniques that are suitable for his problem and his data, and having made his choice, plan his inquiry accordingly.

In the following discussion, which is intended merely as a pilot inquiry, I shall, to begin with, confine myself primarily to assessments for general intelligence and leave motivational factors to a later section. I shall compare assessments for adults and children drawn always from the same families; but I shall adopt a moderately elaborate occupational classification. The data are too crude and limited for a detailed examination by a full analysis of variance. Moreover, in this paper it is my purpose to keep, so far as possible, to the simplest and most intelligible methods of comparison, relying largely on the percentage methods favoured by sociologists themselves. But the differences revealed, I fancy, will be sufficiently striking to lend strong support to the conclusions drawn.

III. Frequency Distributions for Adults and Children

Sources of Data. In studying the distribution of intelligence among the different occupational classes it is in my view desirable to examine, not only (as is usually done) the class-means, but the entire frequency distributions. Accordingly in Tables I and II I give frequencies both for adults and for children. For the children the bulk of the data was obtained from the surveys carried out from time to time in a London borough selected as typical of the whole county. The methods by which the assessments for intelligence were made have been described in earlier papers and in L.C.C. Reports [3, 5, 16]. For the boys who belong to the highest occupational classes, drawn for example from families who would not ordinarily send their children to Council schools, much of the data was collected in the course of work on vocational guidance at the National Institute of Industrial Psychology. The data for the adults was obtained from the parents of the children themselves. Usually our more immediate purpose was to secure practical estimates of both the average level and the range of intelligence required in the commoner types of occupation. In addition, however, when working with backward children we often wanted to see how far the backwardness was a family characteristic. And at all levels an incidental aim was to secure material for studying the problem of mental inheritance. For obvious reasons the assessments of adult intelligence were less thorough and less reliable.

The Occupational Classification. The occupational classification is much the same as that used in previous reports. It has been described by Carr-Saunders and Caradog Jones in their book on *Social Structure in England and*

Wales ([2], Table XXXI, p. 56). Unlike the classification used in the more recent studies of social mobility it is based, not on prestige or income, but rather on the degree of ability required for the work. Class I includes those engaged in the highest type of professional and administrative work (university teachers, those of similar standing in law, medicine, education, or the church, and the top people in commerce, industry, or the civil service); class II consists of those engaged in lower professional or technical work (including most teachers, men of business, and executive clerks in the higher grades); class III of those working in intermediate types of clerical, commercial, or technical work; class IV includes those ordinarily classified as skilled workers, but it also contains an appreciable number who are engaged in commercial or industrial work of an equivalent level; class V consists of semi-skilled workers and those holding the poorest type of commercial position; class VI of unskilled labourers, casual labourers, and those employed on coarse manual work. It will be noted that the numbers in the higher groups or classes are far smaller than those in the lower. These subdivisions were in fact chosen because at the outset of our work we had in mind the proportionate numbers of children (*a*) who were transferred to Central Schools (about 12 per cent), (*b*) who were awarded junior county scholarships and transferred to what were then called secondary (i.e. grammar) schools (about 3 per cent), and (*c*) who were of exceptionally high intelligence and for the most part in attendance, not at a council school, but at one of the older public schools or at a preparatory school of similar type (about 0·3 per cent); and we wanted the occupational classification to tally so far as possible with the educational classification.

In constructing the tables the frequencies inserted in the various rows and columns were proportional frequencies and in no way represent the number actually examined: from class I the number actually examined was nearer a hundred and twenty than three. To obtain the figures to be inserted (numbers per mille) we weighted the actual numbers so that the proportions in each class should be equal to the estimated proportions for the total population. Finally, for purposes of the present analysis we have rescaled our assessments of intelligence so that the mean of the whole group is 100 and the standard deviation 15. This is done because the results of so many intelligence tests nowadays are expressed in terms of conventional I.Q.'s conforming to these requirements.

IV. Amount of Mobility

The Distribution of Adults. From the figures set out in the last column of Table I it will be seen that there are appreciable differences between the average levels of intelligence in the various classes. The average for the highest class of all—those holding the highest professional or administrative appointments—is practically 40 I.Q. points above the general level. The differences between the means for the last three classes are much smaller, largely because the numbers are far greater.

TABLE I. DISTRIBUTION OF INTELLIGENCE ACCORDING TO OCCUPATIONAL CLASS: ADULTS

		50–60	60–70	70–80	80–90	90–100	100–110	110–120	120–130	130–140	140+	Total	Mean I.Q.
I.	Higher Professional									2	1	3	139·7
II.	Lower Professional							2	13	15	1	31	130·6
III.	Clerical				1	8	16	56	38	3		122	115·9
IV.	Skilled			2	11	51	101	78	14	1		258	108·2
V.	Semiskilled		5	15	31	135	120	17	2			325	97·8
VI.	Unskilled	1	18	52	117	53	11	9				261	84·9
	Total	1	23	69	160	247	248	162	67	21	2	1000	100·0

TABLE II. DISTRIBUTION OF INTELLIGENCE ACCORDING TO OCCUPATIONAL CLASS: CHILDREN

		50–60	60–70	70–80	80–90	90–100	100–110	110–120	120–130	130–140	140+	Total	Mean I.Q.
I.	Higher Professional						1		1	1		3	120·8
II.	Lower Professional				1	2	6	12	8	2		31	114·7
III.	Clerical			3	8	21	31	35	18	6		122	107·8
IV.	Skilled		1	12	33	53	70	59	22	7	1	258	104·6
V.	Semiskilled	1	6	23	55	99	85	38	13	5		325	98·9
VI.	Unskilled	1	15	32	62	75	54	16	6			261	92·6
	Total	2	22	70	159	250	247	160	68	21	1	1000	100·0

But still more striking is the wide range of individual differences within each class. With a normal distribution the range for an unselected group of 1000 cases would be (as in fact appears from the table) nearly 100 I.Q. points—i.e., from about 50 to 150; for an unselected group of 100 cases it would be about 75 to 80 I.Q. points. We should naturally expect, however, that the members of the occupational classes will form selected groups, and that their range and standard deviation will therefore be appreciably diminished. In point of fact the standard deviation within the various classes averages 9·6 (i.e. rather less than two-thirds the standard deviation of the entire group, 15). Hence the range for 100 cases would still be nearly 50 I.Q. points (as a glance at classes III to VI will confirm). Indeed, in the lowest class of all—that of unskilled workers—some of the brightest members actually display greater intelligence than the dullest members in class II, the ' lower professional '. The correlation between intelligence and occupational class therefore is by no means perfect. If we attempt to estimate it on the assumption that both distributions are in fact normal, it works out at just over 0·74. However, since the correlation must be far from linear, its precise numerical value as thus calculated can have little meaning.

The fact that the correlation is far from perfect must not be taken to imply that the duller members of the higher classes and the brighter members of the lower classes are all of necessity instances of vocational misfit. No doubt, they sometimes are. But frequently specific abilities or disabilities, and still more often qualities or infirmities of character and temperament, will fully account for the apparent discrepancies.

The Ideal Redistribution. In order to determine what is the maximum amount of interchange that ideal conditions could possibly permit, let us suppose that vocational adaptation depends solely on intelligence. Then in terms of the I.Q. scale the borderlines between the several occupational classes would be 141, 127, 115, 103, and 90 respectively, and there should be no overlapping between the successive categories. If we now reclassify the actual data for adults according to these new borderlines, we obtain the distribution set out in Table III. The number who are placed in occupations corresponding with their intelligence is shown in semi-bold. Before calculating the percentages let us pool the first three classes together to form a single group which is mainly non-manual; and let us combine the next two to form a group of skilled workers (predominantly but not entirely manual), and leave the lowest class as it is. With this threefold rearrangement (Table V) we find that only 55 per cent of the population could be regarded as correctly placed if intelligence were the sole criterion: nearly 23 per cent are in a class too high, and, with a perfect scheme of vocational selection, ought to be moved down: 22 per cent are in a class too low, and would have to be moved up.

The Distribution for Children. When we turn to the data for children (Table II), we observe that the differences between the class-means are much smaller. The average intelligence of the children in the higher groups has

TABLE III. DISTRIBUTION OF INTELLIGENCE ACCORDING TO OCCUPATIONAL CLASS: ADULTS

Rescaled

	VI 50– 91	V 91– 103	IV 103– 115	III 115– 127	II 127– 141	I 141+	Total
I					2	**1**	3
II			1	15	**14**	1	31
III	1	15	38	**56**	12		122
IV	16	86	**114**	38	4		258
V	53	**178**	84	10			325
VI	**191**	46	21	3			261
Total	261	325	258	122	32	2	1000

TABLE IV. DISTRIBUTION OF INTELLIGENCE ACCORDING TO OCCUPATIONAL CLASS: CHILDREN

Rescaled

	VI 50– 91	V 91– 103	IV 103– 115	III 115– 127	II 127– 141	I 141+	Total
I			1	1	1		3
II	1	4	11	9	**6**		31
III	11	28	51	**20**	12		122
IV	46	66	**75**	62	8	1	258
V	91	**122**	84	23	5		325
VI	**112**	105	36	7	1		261
Total	261	325	258	122	33	1	1000

TABLE V. ADULTS: PERCENTAGE IN EACH GROUP WHOSE INTELLIGENCE IS BELOW, ABOVE, OR EQUIVALENT TO THAT OF THEIR OCCUPATIONAL CLASS

	Below	Equivalent	Above	Number
Class I–III	46·2	45·5	8·3	156
Class IV–V	26·6	50·1	23·3	583
Class VI	—	73·2	26·8	261
Total population	22·7	55·4	21·9	1000

TABLE VI. CHILDREN: PERCENTAGE IN EACH GROUP WHOSE INTELLIGENCE IS BELOW, ABOVE, OR EQUIVALENT TO THAT OF THEIR OCCUPATIONAL CLASS

	Below	Equivalent	Above	Number
Class I–III	75·5	16·8	7·7	156
Class IV–V	34·8	34·3	30·9	583
Class VI	—	42·9	57·1	261
Total population	32·1	33·5	34·4	1000

fallen almost half-way towards the mean of the whole population; similarly that of the children in the lower groups has risen by a similar proportion. There is, in short, an overall regression averaging 0·52 (cf. [1], [3]). The figure is very close to the value we should expect on the assumption that the correlation between fathers and sons was due chiefly to multifactorial inheritance with assortative mating and incomplete dominance. If anything, the coefficient is slightly higher than we might expect on these grounds alone [cf. 14]. Hence environmental influences may perhaps have contributed to increase it; but, if so, the contribution must be extremely small.

The phenomenon just noted has sometimes been termed ' biological regression '; and several sociological and psychological writers have claimed that this tendency is responsible for ' the steady progress which ' (so they hold) ' most populations are continually undergoing from a state of individual diversity to one of increasing individual equality ', so that in the more highly civilized communities the distribution of intelligence is approaching ' near-randomness ' as regards both classes and individuals. This interpretation appears to have been adopted as a corollary to the theory of ' blended inheritance ' to which the majority of psychologists and sociologists still adhere[1]. A few writers, however, who recognize that the data obtained from successive generations reveal no evidence whatever for this alleged tendency towards equality, have also postulated a biological ' egression *from* the mean ', which, they argue, " balances regression *towards* the mean " [22]. For this there is no need. With multifactorial inheritance this ' conservation of variance ' is what we should expect.

When we look at the distribution of children's intelligence *within* the several occupational classes and compare it with that of their fathers' (Table I), we see at once that, so far from progressing towards equality, the amount of individual difference has actually increased. The standard deviation has gone up from 9·6 to 14·0, not far short of the standard deviation for the whole population (15·0). Or, to put it in another way, the range for 100 individuals selected according to occupational class has increased from 50 I.Q. for adults to nearly 75 I.Q. for their children.

One incidental consequence of this increase in variability is the appearance of bright children among the offspring of dull parents in the lower occupational classes and of dull children among the offspring of highly intelligent parents in the upper occupational classes. Consider, for example, the lowest occupational class of all. Among the adults only 20 persons out of 261 have an intelligence above the general average; among the children as many as 76, nearly four times as many—a discrepancy of 56. Dr. Floud, and others who hold as she does that differences in intelligence are due wholly to environmental advantages or disadvantages, can hardly maintain that the high level reached by these 76 boys

[1] This corollary from the theory of blended inheritance is mathematically deduced, and empirically disproved, in an earlier issue of this *Journal* (X, p. 56). The empirical disproof of the corollary is perhaps one of the simplest and most convincing arguments against the doctrine of blending. Clarke's ' egression ' is apparently a substitute for Darwin's ' spontaneous variation '.

—all children of unskilled workers—results from the superior advantages which their home environments confer. But equally, those who adopt the traditional theory of blended inheritance, would find it quite impossible to explain the higher intelligence of these children in terms of their heredity. On the Mendelian hypothesis, however, such apparent anomalies are exactly what we should anticipate if the amount of a child's intelligence is determined mainly, or at any rate largely, by his genetic constitution, and if that in turn is the result of a chance recombination of parental genes ([14], p. 97).

Similar arguments hold good for the marked discrepancies discernible in the upper part of the distribution. In the first three occupational classes, for example, we see that among the adults only 9 out of 156 had an intelligence below the general mean, among the children as many as 39. Here again the increased numbers would be almost inexplicable on the environmental theory, but a natural consequence of the Mendelian theory of polygenic inheritance.

Consequences of the Intergenerational Changes. We have seen that two changes result from the comparatively moderate correlation that obtains between the intelligence of parents and their children: (i) the mean intelligence of the children belonging to each occupational class deviates far less than the mean of the parents from the average for the population as a whole, and (ii) the intelligence of the individual children within any one class varies over a far wider range than that of their parents. Moreover, unless their effects are in some way counteracted, both these changes will be cumulative. After about five generations the differences between the class-means would virtually vanish, and the proportional range within each class would spread out almost as widely as the proportional range of the population as a whole[1].

Now all the evidence shows (p. 5 above) that in point of fact, during the period with which we have been concerned, the occupational distribution of intelligence has remained fairly constant from one generation to the next, and it appears likely to do so in the immediate future. If therefore, when they are grown up, the children of Table IV are to exhibit the same distribution as the adults of Table I, it follows that a considerable number will have to move into a fresh occupational class. Some will go up the social ladder by one or more rungs; others will go down. One of our chief problems therefore is to assess the extent of this migration. For this purpose it will be helpful to begin by rearranging the figures for the children according to the method we have already adopted for the adults (Table III above).

Maximum Mobility. Table IV shows the distribution of the children with the scale for intelligence subdivided afresh so that the lines of division shall correspond with those we should expect between the different occupational classes if occupational efficiency depended solely upon intelligence. As before, let us group together classes I, II and III to form a non-manual group, and

[1] This is a simple mathematical corollary. Allowing for assortative mating and partial dominance, the correlation between occupation and intelligence after n generations would sink to approximately $0{\cdot}74 \times \frac{1}{2} \times (2/3)^{n-1}$: (See [14], p. 116, eq. 23).

classes IV and V together to form a group of skilled workers, leaving class VI as it stands to form a group of unskilled workers. Then, assuming intelligence to be the sole criterion, it appears (as a little mental calculation will quickly show) that in the highest group 75 per cent of the children have an intelligence below the minimum that would be needed if they were to become efficient members of the occupational group into which they were born; on the other hand, in the lowest group 57 per cent have an intelligence well above the meagre amount required for an unskilled worker (see Table VI). In the entire sample over a third of the children have an intelligence which would apparently fit them for a higher occupational class than that of their fathers, and rather less than a third have an intelligence which would be more appropriate for a lower class.

These figures give a rough indication of the amount of movement upward or downward from one class to another which the children would have to undergo when grown up in order that the type of work they secured corresponded with their degree of intelligence—always assuming that intelligence was the sole criterion. In point of fact we know that nothing like this amount of movement actually takes place; and the figures, of course, merely indicate the *maximum* degree of mobility that is theoretically conceivable.

Actual Mobility. Let us now return to the question of fact. The ideal and most direct procedure would be to plan a longitudinal study of a large and representative sample, following up the children from school to middle life. A complete inquiry of this kind has so far never been attempted. Both in America and in this country follow-up studies have been undertaken for certain selected groups—the gifted or the backward; but for our present problem these provide at most only supplementary or confirmatory evidence. We are obliged therefore to fall back on the alternative procedure commonly adopted in similar situations; and, instead of comparing the same group at two widely diverging intervals of time, we shall compare two different groups of widely divergent ages.

Our present data supply us with two such samples. These are comparable, since the adults are the parents of the children. However, there is a difference of 28·4 years between the average age of the children and the average age of the adults; and, as we have seen, during that amount of time there would have been a variety of changes in the population. Our method of reducing the figures observed to numbers per 1000 should sufficiently allow for the change in the absolute size of the population. The differential birthrate may have entailed some slight modification in the mental quality of the population; but, in the space of three decades only, the extent of the change would, as we have seen, be almost negligible. The effects of the deathrate are largely ruled out by the fact that we have taken children who have survived to school age. Although between 1911 and 1951 the proportion of men and women over 65 very nearly doubled, this was offset by a decline in the number of boys and girls under 15: and the proportional number of males of employable age has remained much the same. The type of work available has changed appreciably: the number of those engaged in manufacturing and in professional and administrative work of various kinds

has increased; the number engaged in agriculture, in the extractive industries (mining, quarry, etc.), in domestic work, and in the distributive trades has diminished; moreover, the amount of prestige attaching to different types of occupation has altered. Nevertheless, these further changes are hardly relevant to our present problem, as we have formulated it, although in a more intensive study the bearing of all the varying conditions I have mentioned should undoubtedly be systematically examined.

Assuming then that the data in our two samples are reasonably comparable, our primary task is to determine what kind of compensating change would be necessary to bring the frequency distributions for the children (Table II) into conformity with the frequency distribution for the adults (Table I). Let us look first at the lowest occupational class of all—the unskilled workers (class VI). Among the children, it will be remembered, as many as 57 per cent have an intelligence above what is required for work of this type as against 27 per cent of the adults (Tables V and VI). Hence $(57-27)=30$ per cent of the children will presumably move up to a higher occupational class as they grow up. Similarly $(75-46)=29$ per cent of the upper group—that comprising classes I, II and III—will move down. In the intermediate group—classes IV and V—the changes both upward and downward will be smaller. Thus, as a comparison of the last lines of the two tables suggests, the over-all mobility will be at least $(55-33)=22$ per cent. This figure I regard as indicating the minimum amount of mobility—the amount that is required to maintain what (if I may borrow a phrase from the astronomers) might be called a ' steady state '[1]. It constitutes what may be termed ' basic mobility'.

[1] The foregoing data and the analysis I have here attempted will, I hope, dispose of one of the strongest objections urged by Dr. Halsey [21] against the arguments brought forward by Miss Conway and myself in our endeavour to account for the wide differences in average intelligence shown by the different socio-economic classes. Dr. Halsey's criticism was that the round figures assumed for social mobility in setting up our genetic model were far too high. But our object then was of course very different from our present purpose. We merely wanted to show that, with a comparatively small amount of interchange between the several classes, a society which started from primitive conditions in which the average intelligence in the different classes was practically the same would, in the course of subsequent generations, be differentiated in such a way that the differences between the mean levels of intelligence corresponded pretty closely with those at the present day. For this purpose we deliberately assumed in our hypothetical model an amount of mobility well below that which we believed had actually occurred in order to forestall incidental criticisms on this point. In view of the figures given by sociologists themselves Dr. Halsey's criticism seemed rather surprising. But we now hope that the foregoing analysis will show that our postulated figure was well below the most probable minimum.

It has been objected that any figure for social mobility, like that given above, is bound to vary with the lines of division adopted in classifying occupations. However, as long as the basis of the classification remains unaltered, changes in the lines of division will not seriously affect the estimated figure unless the lines of division become so few and the resulting classes so large that the amount of movement is obscured. Indeed, if we imagine the various occupations to be graded according to difficulty in such a way that the distribution of the employees is approximately normal, then in theory, provided we know (i) the correlation between the intelligence of the employees and grade of the occupation, and (ii) the correlation between the intelligence of the employees' children and that of the employees themselves, the amount of mobility required to keep the population constant could be determined from the properties of the bivariate frequency distribution.

However, as we have already seen, there was, at the time when the occupations of the fathers were recorded, considerable room for improvement in the degree of adjustment between the capabilities of the individuals and the type of employment they followed. Moreover, during the last forty years or so, as several researches in the field of vocational guidance have shown, the degree of adjustment has appreciably increased, and apparently is still increasing. Hence the actual amount of mobility is probably much greater than that which just suffices to maintain the *status quo ante*. If we may trust the most thorough of the recent inquiries [13], the overall amount of mobility would appear to be in the neighbourhood of 29 per cent—well above our minimum for a steady state, but still far below what the ideals of vocational suitability would require. Much the same figure was obtained from our analysis of after-histories (p. 19)—viz. 31 per cent.

As the reader will realize, the foregoing deductions deal only with a very limited aspect in a very limited interpretation of the rather ambiguous phrase ' social mobility '. Ordinarily the discussion of mobility treats a rise in social status as implying something more than a mere rise to a type of occupation which requires a higher I.Q. than the occupation followed by one's father[1]; and the value attached to different types of occupation as a goal for the ambitious youngster varies widely from group to group, from individual to individual, and from one period to another. Nor is intelligence the only factor which determines whether or not the ambitious youngster will succeed in achieving the vocational career at which he aims.

I propose therefore in conclusion to glance at two or three other factors which might be expected to influence the kind of occupational status which persons of varying intelligence are likely to attain, and consider what is their relative importance and how far they could affect the inferences already drawn.

V. Causal Factors

Data. Although opinions have been freely expressed about the conditions which facilitate social advancement and still more often about those which are thought to obstruct it, surprisingly little factual evidence has been obtained. The teaching of Samuel Smiles and his Victorian doctrine of ' Self-Help ' has long since faded from memory, though his biographical illustrations are by no means valueless. However, during the past fifty years the popular tendency has been to place an increasing emphasis on the external or social factors and less on the personal or psychological. But here it is principally the latter which I should like quite briefly to examine.

[1] As I have pointed out elsewhere, in their definitions of social class and social status different writers have relied on a wide variety of criteria ([12], pp. 37f. and refs.). The problems to which discussions of this type give rise are most readily handled by means of factor analysis. It turns out that all the criteria are positively, and indeed closely, correlated: so that a general factor must underlie them all. Hence the ideal way of allocating persons to an appropriate social class would be to use a system of weights based on a multiple regression equation. The use of such a technique of course implies that the necessary data have been collected for all the individuals concerned.

As part of the longitudinal studies of gifted and of backward children attending London County Council schools my colleagues and I have followed up into later life a large number of cases, not only of these somewhat exceptional types, but also of normal or average children who were treated as control groups. We now possess fairly detailed data for just over 200 ordinary children who have already reached an age when it is possible to say either that they have already moved out of their original class, in one direction or the other, or else that it is now practically certain that they will never do so. We have similar numbers for pupils who formerly attended central schools or won junior county scholarships as well as for pupils who were educationally subnormal. By using fractional weights for the figures obtained from these various subgroups we can compile a composite group of males which shall be reasonably representative of the total population. It includes many of the older children in the group discussed in section II—those whom we have been able to trace and follow up in their after-school life; but it includes others omitted from that group owing to lack of adequate data about their parents' abilities. For each of the sub-groups we have the following relevant information, obtained (except for vi) mainly when the children were at school: (i) the occupational class of the fathers at the time the children were born; (ii) assessments and descriptions of the home background, and particularly of the attitude of the family towards the child's social advancement; (iii) the child's own attitude, and particularly his industry, ambition, and educational and vocational aims; (iv) his level of intelligence, based on tests duly checked with the teachers and corrected where necessary; (v) his educational record (more especially his admission to a grammar school or its equivalent); (vi) his occupation when last visited.

In view of the complexity of the problem and the limitations of the data let us begin by an analysis in terms of crude percentages. For this purpose we may divide the whole composite group into three portions—(*a*) those who have remained in their original occupational class, (*b*) those who have moved up, and (*c*) those who have moved down. Similarly, it will simplify matters to reduce the assessments for intelligence to a threefold classification—(*a*) an intelligence equal to that required in the individual's original occupational class (the class of his father), (*b*) an intelligence above it, and (*c*) an intelligence below it. The other assessments can be reduced to a twofold classification, viz. (*a*) above the median and (*b*) below the median[1].

Results. The main results are shown in Table VII. The following conclusions may be drawn.

1. Of the children with an intelligence *below* the minimum required for the occupational class into which they were born none rose above it, and about a third (or rather more) dropped to a lower class. On the other hand, of those

[1] For much of the data in this section, and most of the calculations, I am deeply indebted to my former colleagues, Miss J. L. Hastings, Miss E. Davenport, and Mr. R. M. Weldon.

who had an intelligence *above* the maximum required for their original occupational class nearly 60 per cent failed to rise.

2. Very few of those who were assessed as lacking in adequate motivation rose above their original class. Indeed, poor motivation was more likely than poor intelligence to contribute to a fall. On the other hand, good motivation was less certain to secure a rise.

3. A good home background, though helpful particularly during the earlier educational stages, was less effective in securing a rise than either high intelligence or strong motivation. Nor was a bad home background so fatal as seems to be commonly assumed. Nearly a quarter (24 per cent) of those who suffered from unfavourable home circumstances in childhood nevertheless succeeded in rising out of their original class.

TABLE VII. PSYCHOLOGICAL FACTORS INFLUENCING OCCUPATIONAL MOBILITY

	Intelligence			Motivation		Home Background		Educational Achievement	
Mobility	P	A	G	P	G	P	G	P	G
Up	0	12	41	2	36	24	29	18	34
Stationary	64	67	49	47	51	40	44	34	52
Down	36	21	10	51	13	36	27	48	14
	100	100	100	100	100	100	100	100	100

	Intelligence and Motivation Combined		Intelligence, Motivation, and Home Background Combined		Intelligence, Motivation, Home Background, and Educational Achievement Combined	
Mobility	P	G	P	G	P	G
Up	0	66	0	70	0	72
Stationary	32	29	23	23	18	21
Down	68	5	77	7	82	7
	100	100	100	100	100	100

Note.—P=Poor, A=Average, G=Good. The tables for 'combined' qualities include only those cases in which *all* the qualities specified were 'Poor' or 'Good'.

4. The achievement of grammar school status or (during the pre-war period) the award of a junior county scholarship, by no means sufficed to guarantee a rise in occupational class, though it often proved an important step in the child's gradual ascent. However, an appreciable number succeeded in working their way up to a higher occupational level in spite of a total lack of any formal education beyond what the elementary school could provide.

5. Two-thirds of those who have both high intelligence and strong motivation are likely to achieve an occupational rise. In fact nearly all who achieve a rise have this double characteristic. The addition of a good home background

is a further advantage; in the case of the child of the lower classes what chiefly count are the social aspirations, the ambitious aims, and the constant urging that often characterize the more earnest working-class parents; with children from higher levels it is rather the intellectual and cultural character of the home that helps. The addition of a grammar school education does not greatly increase predictability[1]: this is because most children who have good intelligence, good motivation, and good home backgrounds are pretty sure to win their way to a grammar school. Those who, despite high intelligence and good motivation, dropped to a lower occupational class were for the most part victims of ill health, either mental or physical. As the tables indicate, there was actually an increase in this type of failure among those who in addition enjoyed a good home and a good education; the increase, as the case-histories would show, is accounted for by the larger number who break down from nervous ill health.

There are many other possible factors of a somewhat miscellaneous kind which have not been included in the foregoing summary—e.g. the variations in the openings available at different times or in different regions, the effects of a wife and family, or of friends, acquaintances, or patrons able to help and wielding personal influence. From time to time we encountered evidence of such factors; but as determinants of individual mobility they seemed to be of much less importance than those we have discussed.

An Analysis by Factors and Variances. The relations between the five main variables can be roughly expressed by means of correlation coefficients. For this purpose we have assessed mobility in terms of the degree of movement as well as the direction, allotting ± 1 point for a movement to the class above or below, ± 2 points for a movement over two classes, and so on. The correlations obtained are shown in Table VIII. The correlations between social mobility and the various causal conditions are product-moment coefficients; the correlations of the causal conditions with each other are averaged tetrachorics.

The raw correlations between social mobility and the four main causal conditions differ but little in magnitude; but the partial correlations (last row of Table VIII) differ appreciably. The correlation with intelligence is by far the highest of the three (0·38); the correlation with motivation is somewhat smaller (0·29); and the correlations with home background (0·17) and educational achievement (0·05) almost negligible. These figures thus fully confirm the conclusions already reached. The partial regression equation for predicting mobility is

$$S = 0{\cdot}346I + 0{\cdot}272M + 0{\cdot}158H + 0{\cdot}149E,$$

where S denotes social mobility, I intelligence, M motivation, H home background, and E educational achievement. The multiple correlation is 0·628.

[1] Education, and particularly the type of education (e.g. entrance at a public school followed by Oxford or Cambridge), are unquestionably influential in determining a rise at the highest levels of all; but in a survey of the total population such cases appear by comparison few in number and exceptional in type.

This rather modest value is no doubt due to the fact that, as we have seen, various minor factors may be operative in individual cases[1].

Table IX gives the results of the factor analysis. The matrix of correlations between the four causal conditions was first subjected to a group factor analysis, the lines of division between the groups being determined by a preliminary bipolar analysis. The correlations between social mobility, etc., and the resulting factors were then computed by the usual formula. In determining the meaning of the factors we have relied partly on the case-histories of a few

TABLE VIII. CORRELATIONS BETWEEN SOCIAL MOBILITY AND RELATED CONDITIONS

	1	2	3	4	5
1. Social Mobility	—	0·481	0·402	0·396	0·378
2. Intelligence	0·481	—	0·133	0·236	0·413
3. Motivation	0·402	0·133	—	0·376	0·162
4. Home Conditions	0·396	0·236	0·376	—	0·363
5. Educational Record	0·378	0·413	0·162	0·363	—
Social Mobility (partial correlation)	—	0·379	0·286	0·174	0·047

Note.—The partial correlations give the correlation between social mobility and the condition specified when the effects of the other three conditions are held constant.

TABLE IX. CORRELATIONS OF SOCIAL MOBILITY AND RELATED CONDITIONS WITH GROUP FACTORS

Factor	I	II	III	IV
1. Social Mobility	0·443	0·417	0·294	0·166
2. Intelligence	0·782	0·000	0·405	0·000
3. Motivation	0·000	0·731	0·329	0·000
4. Home Conditions	0·302	0·514	0·000	0·287
5. Educational Record	0·528	0·216	0·000	0·323

typical individuals who have obtained exceptionally high or exceptionally low factor measurements for each of the factors. The first factor appears to be essentially an intellectual factor; and the second a factor of incentive. The last two are based on a bipolar factor which apparently distinguishes variations that are mainly genetic from variations that are mainly environmental But the precise interpretation of factor III remains somewhat obscure[2].

[1] The method is similar to that adopted in an earlier memorandum and subjected to considerable criticism: for a reply see [6], pp. 278f.

[2] Factors I and II must each of them be partly determined by genetic characteristics. Factor III seems to imply some overlap or linkage between the genetic characteristics that make for intelligence and stability of character respectively—perhaps due merely to the fact that intelligence is an ingredient of stability, or perhaps due to some selective conditions influencing the genetic basis of both.

Between them the four factors contribute about 48 per cent of the total variance for mobility: of this, factor I contributes nearly 20 per cent, factor II 17 per cent, factor III 9 per cent, and factor IV barely 3 per cent.

Owing to the imperfect nature of the data and the methods of calculating the correlations it seems very doubtful whether much value can be attached to the figures thus obtained. We give them chiefly in the hope that their shortcomings may encourage fresh investigators to plan a more systematic set of longitudinal studies, with the method of analysis kept carefully in view from the very outset, and so in the end reach a more reliable basis of comparison[1].

VI. Summary and Conclusions

1. As a convenient criterion for vocational adjustment it is assumed that, if the available occupations are grouped in order of the difficulty of the work they entail, and if the men engaged on them are grouped in order of intelligence, then there should be a perfect correspondence between the two series. Judged by this criterion it appears that well over 20 per cent of the male adults in this country have a higher intelligence than is requisite for the work they are doing and that about the same number have an intelligence which is inadequate. Many of the discrepancies, however, are accounted for by individual differences in qualities of personality or character or in special abilities or aptitudes relevant to the work concerned.

2. Owing to the imperfect correlation between the intelligence of parents and the intelligence of their children the discrepancies between the children's intelligence and the occupational category of the parents are still greater. This follows from the multifactorial theory of inheritance, and is amply confirmed by the data here examined. The figures indicate that an overall mobility of about 22 per cent is needed to keep the distribution of intelligence approximately constant from one generation to another within each occupational category. If the distribution of character-qualities could also be taken into account, a still higher figure would no doubt be obtained. There is, moreover, considerable evidence to suggest that the degree of general vocational adaptation is improving; and, partly for this reason, it is estimated that the total amount of intergenerational mobility must be nearer 30 per cent.

3. Of the various causal factors affecting the individual's rise or fall in occupational status differences in intelligence and motivation appear to be the most influential. Differences in home background and in education seem to exercise a secondary or supplementary influence, but without the basis of the first two they are of little effect.

[1] I am much indebted to Miss Howard for assistance with the calculations involved in this section.

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