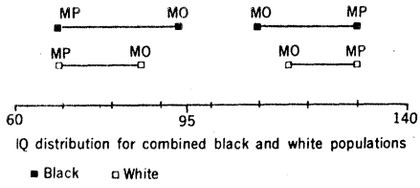

Fig. 1. A hypothetical regression of mid-offspring (*MO*) IQ from midparent (*MP*) IQ in black and white populations where heritabilities are unequal.

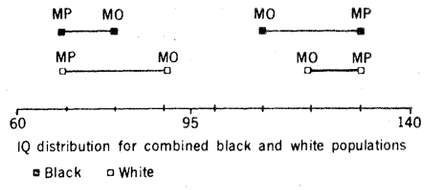

Fig. 2. A hypothetical regression of mid-offspring (*MO*) IQ from midparent (*MP*) IQ in black and white populations where heritabilities are equal.

true some years ago. I am not at all sure that higher IQ blacks tend to marry whites or only light-skinned blacks.

In any case, a control for the effects of family rearing environments can be provided. An interesting test of the genetic hypothesis on admixture could be made on within-family variation, using DZ twins. Members of a DZ pair may vary in skin color, IQ scores, and serological estimates of admixture; they vary little in rearing environments.

From a genetic point of view, partialing out the correlation (if any) between skin color and IQ from the correlation (if any) between serological admixture and IQ can result in the loss of some genetic variance as well as environmental effects. Skin color is not only a visible marker for social discrimination, but also an independent genetic marker for admixture. Thus, the first method proposed to study racial differences in IQ is fairly conservative and unambiguous, I think. Its feasibility depends on the constantly increasing number of blood loci for which population differences between African and European populations are known. I was not advocating its feasibility so much as its logic.

Regarding the second indirect method I proposed, Willerman is correct in stating that regression from parent to offspring results from nonheritable portions of variance in IQ, or any trait. But he errs in his interpretation of different regression effects in the two racial groups at the two ends of the IQ distribution.

First, I specifically cited the need for regression to be calculated at the high *and low* ends of the IQ distribution. It is essential that the offspring of parents of equal midparent IQ's in the two racial groups be compared above and below the observed population mean. Second, I assumed that the heritabilities of IQ scores in the two racial groups would have been calculated, because without them the formulas for predicting regression effects are not soluble. I also assumed that the assortative mating coefficient was known.

The prediction of the null hypothesis is that no differences in regression will be found between blacks and whites at any point in the IQ curve. The null hypothesis could be rejected in several ways.

First, the heritabilities for IQ could differ in the two populations, so that regression effects from parent to offspring would be greater both above and below the empirical population mean in one or the other racial group (Fig. 1; since the more likely hypothesis is that heritabilities are somewhat lower in the black than in the white population, that is the one illustrated). The result shown would indicate lower heritability in the black population but a similar population mean. Other charts could be drawn to indicate unequal regression and unequal population means.

Second, the heritabilities for IQ could be approximately equal in the two racial groups but the regression effects could be unequal both above and below the population mean (Fig. 2). Since regression effects are greater at the extremes of a distribution, this result would indicate that similar midparent IQ's represent different points on the IQ distributions of the respective populations. The most likely interpretation of these results is that the two populations have different means. The different means, as hypothesized in Fig. 2, would suggest genetic racial differences, in part for the reason Willerman gives: "chance failures to reproduce in the children unusually good [or bad] genetic interactions that each parent was fortunate [or unfortunate] enough to have."

It is possible, however, to interpret Fig. 2 as showing exclusively environmental effects. To the extent that racial discrimination and the multiple disadvantages of minority group status affect the development of IQ, high IQ black parents can be said to be less able than whites of comparable IQ to give their children favorable rearing conditions. Similarly, low IQ black parents may give their offspring an even less favorable environment than equally low IQ white parents give theirs. Thus, the regression effects observed to be greater at the high IQ end for blacks and at the low IQ end for whites could be the result of complex and unquantified environmental differences between the groups. The environmental explanation lacks the parsimony of simple genetic principles like independent assortment, but may be true nonetheless.

Many other models of regression effects for the two racial groups could be suggested, but these are illustrative of possible results. I am led by additional thought to conclude that the results of regression studies, while interesting, are probably ambiguous when considered apart from other data. Only acceptance of the null hypothesis of no differences in regression would be an unambiguous outcome.

In his last paragraph Willerman touches on an extremely important point that is often misunderstood. The study of genetic differences is not the study of genetic determination. Studies of genetic differences ask questions about genetic and environmental contributions to *variance* among us, without respect to known gene loci and specific gene action pathways. Studies of genetic determination can ask questions about the links between gene loci, biochemical pathways, anatomy, and behavior, without respect to variation among us. As Willerman suggests, knowledge of biochemical pathways to brain development is crucial, presumably because such knowledge will lead to effective treatment for retardation and other intellectual problems. Studies of genetic differences cannot supply this information.

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Unemployed Engineers

Philip Abelson's editorial (12 Nov. 1971, p. 651) presents an inaccurate picture of the employment status of scientists, as do most other sources.

The oft-quoted National Science Foundation report (*1*) mentioned by Abelson provides data on the status of respondents to a questionnaire which was sent to the respondents of a previous questionnaire (*2*). It is doubtful whether this kind of sample is a representative one.

A 1971 study (*3*) by the Engineers Joint Council (EJC) identifies some of the inadequacies of a companion NSF report on engineers (*4*) and indicates substantially higher unemployment rates than does the NSF report. But even the EJC's method of selecting respondents results in limitations in the applicability of the data.

U.S. Department of Labor figures, as well as those of individual states, have inherent problems of classification as well as sampling technique. In Massachusetts, for example, extrapolation techniques developed for use in "normal" times are of questionable value when used during a period of prolonged unemployment. These techniques resulted in an official unemployment figure for scientists and engineers in mid-1971 of 4200 (*5*). Others have estimated that there were between 10,000 and 20,000 unemployed scientists and engineers in Massachusetts at that time, and between 100,000 and 200,000 in the nation (*6*); these estimates correspond to an unemployment rate of about 10 percent, which is more consistent with my own observations.

During the past year, an inordinately large number of frustrated, disillusioned, and desperate scientists and engineers have accepted underproductive and unrewarding employment. But government questionnaires (*7*) have not been designed to elicit data on underemployment, and government analyses ignore it. This accounts in part for the questionable credibility of government figures and analyses.

Abelson suggests that researchers enter the overcrowded arena of technology-oriented companies as a step toward solving the researcher's employment problem. The answer to their problem does not lie in displacing others from their jobs or in scrambling for the meager scraps that are being strewn among us for political mileage. This approach results in the community of scientists and engineers being divided and conquered, as it is at present.

The current administration made a conscious decision to permit the unemployed, including scientists and engineers, to bear the brunt of controlling inflation. This was implemented despite the severe human cost and the long-term compounding of national problems.

The federal government, and the Administration in particular, control the purse-strings that must be adjusted to promote employment, increase productivity, and address the pressing problems of national concern, toward which technology can contribute substantially. These goals are in the interest not only of scientists and engineers, but of the nation as a whole. We must not be sidetracked by cautions against overindulgence, while ignoring the continuing unemployment and underemployment crisis. Current economic practice, which inevitably results in personal disaster for many of us, is unacceptable.

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Old-Fashioned Virtues

Maesen and Maesen (Letters, 28 July, p. 293) suggest that universities return to "such 'old-fashioned' virtues as academic competence, high intellectual standards, and far-reaching preparation, rather than 'the customer (student, public, and so forth) is always right' mentality." I am unable to decide whether this is a serious comment or whether it was meant ironically. It closely parallels numerous passages in C. P. Snow's books, in which he describes the reactions of Greek and Latin scholars to the demand for relevance by their students, who had the temerity to insist that science should be added to the university curriculum.

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