Educability and group differences

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Professor Jensen replies to criticism of his book Educability and Group Differences *made by Professor J. M. Thoday in a review published in* Nature.

I WISH to reply to the two main points of criticism made in the review of my book, *Educability and Group Differences*, (Methuen, London, 1973) by Professor J. M. Thoday in *Nature* (**245**, 418–420; 1973).

I had reported that when white and negro children were matched for a particular IQ score, say 120, the siblings of the two racial groups differ in average IQ, and that the difference is consistent with the phenomenon known as 'regression to the mean'. The white siblings regress toward the white population mean IQ of 100, the negro siblings toward the negro population mean of 85. The amount of regression is predictable in both racial groups from a genetic model in which the genetic correlation between sibs is 0.05 and the heritability, h^2, of IQ is 0.80. The same model, using different empirically estimated values for h^2, is applicable to any other continuous traits, such as height, weight, and fingerprint ridges. (In the present example, approximately the same amount of sibling regression was found for height as for IQ, and the same equation predicts as well for negroes as for whites.) All these findings are consistent with an already existing polygenic model which has proven theoretically valuable in understanding variation in metrical characteristics, physical and behavioural.

Factor X

But Thoday claims that a finding such as I reported ". . . adds nothing whatsoever to the strength of the genetic hypothesis" on the ground that the evidence is also as compatible with an explanation in terms of a hypothetical environmental "factor X" as in terms of the genetic hypothesis. But "factor X" is, of course, a purely *ad hoc* hypothesis. No previous environmentalist theory or model has been put forth which would have predicted the quantitative aspects of these findings, nor the linearity of regression throughout the middle 98% of the IQ range, nor the similarity of regression for IQ, height, and weight, nor the fact that the same regression equation works equally well for both racial groups. All these points, whcih are consistent with a much larger body of genetical theory and findings applicable to all organisms, would have to be regarded as coincidences in terms of the purely *ad hoc* hypothesis that some as yet unidentified environmental "factor X" is responsible. The findings, of course, cannot prove or disprove any *ad hoc* hypothesis which is invented expressely to explain them. But the fact that they are consistent with a genetic model which is not *ad hoc* is a point in favour of the genetic explanation. Philosophers of science, I believe, would support my contention. In fact, a forthcoming article, "Progress and Degeneration in the IQ Debate" by Dr Peter Urbach (*Br. J. Phil. Sci.*) argues that the chief weakness of the environmentalist position is its extreme recourse to *ad hoc* explanations, often mutually inconsistent, of findings which were predicted by, or which easily fit into the framework of, already existing genetical theories supported by a growing internally-consistent network of evidence.

Thoday's second criticism is intended as an example of uncritical acceptance by me of some evidence which seems to favour a genetic hypothesis.

It involves my reference to a published study by DeLemos, which shows that a sample of full Australian aboriginals performed significantly less well on several of Piaget's tests of conservation than did part aboriginals (with the average genetic equivalent of one Caucasian greatgrandparent), despite the fact that the two groups shared much the same general environment without any distinguishable systematic environmental differences between the full and part aboriginals. Since the Piagetian tests, which are intended to reflect changes in mental maturity, are sensitive to age differences, and DeLemos's subjects ranged in age from 8–15 yr, Thoday conjectures that the findings reported by DeLemos could be an artefact of her not having controlled for age. The much more detailed presentation of the data and other analyses in DeLemos's PhD thesis (460 pages), of which I obtained a microfilm copy in 1967 and on which her later published article was based, however, shows that Thoday's statement that "the data cannot be regarded as demonstrating that the ancestry difference has significant effects" is not borne out by the evidence. Nor did I notice any other likely artefacts in my reading of DeLemos's thesis. My personal discussion of this research with Dr DeLemos, in 1969, added to my confidence in her conduct and analysis of the study.

Partial correlations

The invalidity of Thoday's conjecture can be demonstrated perhaps most simply by a reanalysis of the original data provided by DeLemos, using partial correlations. I have performed this analysis, based on all 80 subjects from the Hermannsburg group (42 full and 38 part aboriginals) ranging in age from 8–15 yr. Intercorrelations were obtained between age in months, the exact percentage of Caucasian ancestry, and total score on the six tests of conservation (each test scores as 0, nonconservation, 1, transitional; 2, conservation). The zero order correlations among these variables are: age × %Caucasian ancestry: $r=0.192$ ($P<0.05$); age×total conservation score: $r=0.350$ ($P<0.01$); % Caucasain ancestry×total conservation score: $r=0.478$ ($P<0.01$). If the correlation between ancestry and conservation score depends upon the correlation of each of these variables with the third variable, age, for example, then the partial correlation between ancestry and conservation, with the effect of age statistically held constant, should be reduced to a value not significantly greater than zero. If, on the other hand, the partial correlation is significant, it means that ancestry makes some contribution to the conservation score independently of age. The partial correlation between Caucasian ancestry and conservation score turns out (independent of age) to be 0.448, which is significantly greater than zero at the 1 % level of confidence. A more complex type of analysis (ANOVA of total conservation scores, with ancestry nested within 1 yr age groups), too involved to present here but which does not make any assumptions about linearity of regressions as is implicit in partial correlations, fully supports this conclusion that DeLemos's finding is not attributable to age differences between the full and part aboriginals. Also, it can be shown that the sex of the subjects has no signficant relationship to any of the other variables in DeLemos's study.

The fact that another study of conservation in full and part aborigines, by Dasen (published in 1972, after my citation of the DeLemos study was in press), failed to find a significant relationship between ancestry and conservation performance does not automatically invalidate the DeLemos study, which appears methodologically at least as sound as the Dasen study. The latter involved certain procedural and sampling differences, so that it cannot be regarded as a true attempt at replication of the DeLemos study. Dasen's discrepant findings do mean, however, that the findings by both DeLemos and Dasen are not clearly understood in terms of the precedural variables affecting performance and that neither's results are generalisable to the general population of aboriginals or to other tests of conservation. The only answer for this state of affairs, which is of course a common occurrence in empirical research, is to systematically pursue further investigations in the same vein.

letters to nature

Absence of soft X rays from Eta Carinae

THE X-ray telescopes on OAO-Copernicus have been used to search for X-ray emission from η Carinae. The instrumentation has been described elsewhere[1-2]; briefly, it comprises two paraboloidal X-ray telescopes operating in the energy ranges 0.5–1.5 and 1.5–4.6 keV, with a separate collimated proportional counter operating from 2.5–7.5 keV.

The energy source of η Car, first seen in the optical spectrum[3] and now in the infrared[4], is not yet entitely clear[5,6]. Thackeray[5] suggested that it belongs to a new, slow class of supernovae associated with the birth of an expanding stellar association, and Ostriker and Gunn[7] have developed a supernova model of large mass ($\approx 50 M_\odot$) energised by a central neutron star and emitting synchrotron radiation from the surrounding nebulosity in the optical and infrared[8]. Alternatively[6], the object may be a very massive star (600–100$M_\odot$) which is vibrationally unstable and has ejected a fraction of a solar mass to form the observed nebulae and condensations[9]; or it could be a very young massive star approaching the main sequence[3,6]. On either of these last two hypotheses the radiation is entirely thermal: the optical continuum results from a hot central star or from two-photon emission from metastable hydrogen, and is distorted by reddening in a circumstellar dust cloud[10] which re-emits the absorbed radiation in the infrared[11,12]. The thermal model, more probably involving a hot central star, is strongly supported by the relative intensities of emission lines of hydrogen[13] and permitted[14] and forbidden[10] FeII, by the detailed analysis of Davidson[15] and by the presence of silicate bands near 10 μm (ref. 16); but measured intensities of [S II] lines do not show the expected intrinsic reddening[17].

On the synchrotron model, inverse Compton scattering may lead to an observable X-ray flux[18], which would probably be accompanied by intense synchrotron X rays if the 'pulsar' mechanism were operative. On either model the observations of an expanding shell moving out into the surrounding medium must imply the presence of a shock wave with compression and heating of the ambient gas to a temperature at which the emission of X rays becomes important. An observation of η Car in X rays would therefore be of great value in helping to decide between the two models and in setting constraints of the physical parameters involved.

A soft X-ray source found in a scanning rocket experiment[19] was located somewhere near the galactic equator and within 0.3° of the galactic longitude of η Car, with which it was tentatively identified. This unconfirmed identification led Davidson and Ostriker[20] to comment on the parameters of the thermalised shock front which precedes the expanding shell and which was assumed to account for the X rays observed below 2.7 keV. They concluded that the shell must be moving into a surrounding medium of density $\sim 2{,}000\ cm^{-3}$, which was rather difficult to account for, because it implied that η Car had not cleared a cavity around itself by mass outflow before the large outburst of 1843. Another possible consequence of this model is that the green coronal line [FeXIV] λ 5,303 may be present in the visible spectrum[21]. A spectral tracing from the Radcliffe Observatory indicates that this line, if present at all, is considerably weaker than predicted, but this negative result cannot be treated as a very conclusive test of the shock model. The pulsar model seems, on the other hand, to have been ruled out by the steep slope and modest intensity of the observed X-ray flux[20], even if the identification[19] with η Car were correct.

Eta Car was observed by the X-ray telescopes on board OAO-Copernicus on May 25, 1973. Both telescopes used the largest field of view (equivalent beam width 12 arc min) and were pointed 'on' and then 'off' the source for six sets of observations of about 14 min each. The slew 'off' the source was of about 5° in range, and provided a reliable background estimate. No statistically significant difference in count rate was observed in either telescope, which leads to the upper limits (at the 2σ level) shown in Table 1. Similarly, no significant count rate was recorded in the collimated proportional detector, which has a 3° field of view; the corresponding upper limit (Table 1) is slightly below the threshold of the third Uhuru catalogue of X-ray sources[22], which is 3.4×10^{-11} erg cm^{-2} s^{-1} (2 Uhuru units) over the energy range 2–6 keV. An upper limit to the X-ray luminosity L_x of the source, between 0.5 keV and 7.5 keV can be obtained by removing the assumed effect of a column density $N_H = 3 \times 10^{21}$ cm^{-2} on the maximum flux observed in the 0.5–1.5 keV band and extrapolating the continuum to higher energies. Assuming a distance of 2 kpc, this gives $L_x < 2 \times 10^{34}$ erg s^{-1}; the result is approximately the same whether the thermal (kT = 0.26 keV) or synchrotron (α = 0.8) spectrum is assumed, and does not vary significantly for N_H values between 2.5 and 4.8 × 10^{21} cm^{-2}. The interstellar cross sections used here are those of Brown and Gould[23].

Table 1 Upper limits to the X-ray flux from η Carinae

Energy band (keV)	0.5–1.5	1.5–4.6	2.5–7.5
Total count rate (s^{-1})	<0.01	<0.13	<0.025
Maximum energy flux in band erg cm^{-2}s^{-1}	1.6×10^{-11}*	4×10^{-11}*	2×10^{-11}†

* Assuming thermal spectrum[17] kT = 0.26 keV, and hydrogen column density $N_H = 3 \times 20^{21}$ cm^{-2}

† Assuming a synchrotron spectrum, α = 0.8 (ref. 16).