Brit. J. Phil. Sci. **25** (1974), 99–135 *Printed in Great Britain*

Progress and Degeneration in the 'IQ Debate' (1)*

by PETER URBACH

Received 30 *November* 1973

* I owe my greatest intellectual debt to the late Imre Lakatos. Not only was his methodology of scientific research programmes the crucial philosophical influence on this paper, but he also personally devoted an immense amount of time to constructive criticism of earlier drafts.
I also gratefully acknowledge the helpful criticisms of earlier drafts of this paper made by Peter Clark, Colin Howson, John Watkins, Elie Zahar and especially John Worrall, none of whom should, however, be taken as agreeing with all I say.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

INTRODUCTION

In the question of intelligence, all roads lead back to the work of Francis Galton in the late nineteenth century. He was the first to formulate a theory of 'general intelligence'[1]; he pioneered the construction of mental tests; and he was the inventor of experimental methods for investigating the inheritance of mental abilities.

The controversy between those who hold that individual and group differences in intelligence test scores are primarily due to inherited differences and those who hold they are primarily the products of environmental differences is one of the oldest and most acrimonious in social science. The controversy has been almost universally marred by a lack of clearly defined standards by which to assess the rival theories. Whenever such standards *have* been invoked, they have been either utopian[2] or unsatisfactory.[3]

I intend to describe and appraise the rival views of intelligence in terms of Lakatos's methodology of scientific research programmes and thereby to evaluate the two competing programmes in the light of their objective merits. This will also detach the debate from the political positions with which they are falsely associated in the public mind.

My thesis is that the hereditarian-environmentalist rivalry has existed not between two competing *theories* but between two competing *research programmes*. For there have been a *series* of—falsifiable and, indeed, falsified—hereditarian and environmentalist theories, each term in each of the two series dealing with some of the refutations (or anomalies) faced by its predecessor. Each of the two series can be characterised by a set of assumptions (*'hard cores'*) common to all the terms. Moreover, each of the series is associated with certain 'heuristic' machinery guiding the construction of successive hypotheses in the series. Thus both the hereditarian and environmentalist approaches possess all the features identified by Lakatos in major physical scientific research programmes.[4]

[1] 'General intelligence' is a technical term; *cf. below*, p. 111 and section I (*d*).

[2] *Cf. e.g.* Deutsch ([1969], p. 527), who uses inductivist standards and complains that the hereditarian theory goes 'far beyond what is warranted by the data'. But *all* theories go far beyond the 'warranted data': *cf. e.g.* Popper [1934], section **25.**

[3] *Cf. e.g.* Burt and Howard ([1957], p. 55), who use probabilist standards and claim that 'the only way to rebut this [the hereditarian] argument is for the critic to produce a constructive hypothesis of his own, *and formally demonstrate its higher probability*' (my italics). But despite many efforts, no satisfactory way has been found (and none is likely to be found) to rank scientific theories according to their probability: *cf.* especially Lakatos [1968*a*]. *Cf.* also Burt [1957], p. 164, for a defence of hereditarianism on grounds of a 'consilience of inductions'.

[4] For the methodology of scientific research programmes, *cf.* primarily Lakatos [1970], [1971*a*] and [1971*b*]; but *cf.* also his [1963–4], the first case study of a research programme (on polyhedra).

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

In section 1 I shall *describe* the rival hereditarian and environmentalist research programmes. In sections 2 and 3 I shall *appraise* the development of the two programmes.

As Lakatos has shown—referring to the conventionalist arguments of Le Roy and Milhaud[1]—it is relatively easy for any programme to deal with (that is, make its theories consistent with) any given anomalies. In appraising the programmes, the question is whether they do this in a *progressive* or in a *degenerating* manner. The shift within a research programme from one theory to another is progressive if the new theory not only deals with its predecessor's anomalies but also makes extra predictions, some of which are tested and confirmed. On the other hand, if the new theory does nothing more than accommodate the anomalies, the shift is *ad hoc* and the programme degenerating.

The question we must ask about the hereditarian and environmentalist programmes is *not* whether they have been proved from the facts (no programme could be), nor whether they are refuted (even the latest versions of both programmes *are* refuted). On Lakatos's criterion, the fact that a programme is refuted does not, by itself, render it unscientific or unacceptable. The question is whether either programme has successfully 'stuck its neck out' by predicting experimental results which had not been known in advance or whether it simply tinkers with its assumptions in such a way as to accommodate the already observed facts without successfully anticipating further, yet unobserved, *novel* facts, in the general spirit of the heuristic of the research programme.[2]

1 THE HEREDITARIAN AND ENVIRONMENTALIST RESEARCH PROGRAMMES

(*a*) *The Hard Cores of the Two Programmes.*

The hard core of any research programme is not in general likely to be recognisable from the declarations of the scientists involved since scientists do not necessarily *believe* in the hard cores of the programmes on which they work and they sometimes deny them.[3] Moreover, a programme's hard core might never have been asserted or recognised. However, although the private beliefs of scientists provide no guide to the hard core of their programme, this may be identified from the principles which direct their

[1] *Cf.* Le Roy [1899] and Milhaud [1896].

[2] While this paper was being written, Zahar introduced an interesting modification of the concept of 'novel fact' (Zahar [1973], especially pp. 101–4) when analysing the Einsteinian Revolution; and the new standard of appraisal was also successfully applied to the Copernican Revolution (Lakatos and Zahar [1975]). However, the application of Zahar's modification did not lead to any alteration in the conclusions of the present paper.

[3] For some examples of scientists who have disavowed the hard core of the programme on which they worked, *cf. below*, section 1 (*c*).

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

practical research. For the hard core of any research programme has a prescriptive counterpart[1]; that is, it is intimately associated with a certain characteristic *heuristic machinery* which provides strategies for the recognition and resolution of anomalous experimental results.[2]

In this paper, I shall argue that the rivalry in the 'IQ Debate' exists, not between scientists holding this or that *belief*, but between scientists carrying out their research according to the prescriptive rules contained in one or other of two separate heuristics. These are the hereditarian and environmentalist heuristics which I shall describe *below*.[3] I have also connected these two heuristics with corresponding hereditarian and environmentalist hard cores since, if science is more than a mere game, the heuristics must be attached to some propositions describing the world.

Now some scientists may not believe the hard cores I have attributed to their research programmes and others may even disavow them altogether but the fact that their research is performed in accordance with the corresponding heuristic principles entitles us to say that these scientists work *as if* they were inspired by them.

The *hard core of the hereditarian programme* consists of two propositions:
(1) *All individuals possess a general mental capacity called 'general intelligence' which enters with some (and varying) degree into all the diverse types of cognitive activity.*[4]
(2) *Differences between individuals and between groups in 'general intelligence' are the results of inherited differences.*

The *hard core of the environmentalist programme* consists of the proposition:
(1) *All individuals inherit all sorts of different mental capacities but each is identical in each individual; all differences in cognitive abilities are the results of environmental differences.*

Although there is a broad environmentalist programme which covers all mental capacities, I shall in this paper consider only the more specialised version of this research programme which concerns the general mental capacity ('general intelligence') whose existence is postulated in the first proposition of the hereditarian hard core.

Some people think that the 'IQ Debate' is more accurately represented by *one single*, 'interactionist', research programme with a hard core somewhere intermediate between the hereditarian and environmentalist hard

[1] For the connection between metaphysical hard cores and heuristics, *cf.* Watkins [1958].
[2] 'Hard core' and 'positive heuristic' are technical terms of the methodology of scientific research programmes: *cf. e.g.* Lakatos [1970], pp. 132–8.
[3] *Cf. below*, section 1 (*b*).
[4] This at first sight surprising claim will be explained and discussed in section 1(*d*). As I shall show there, the claim and the central notion of *general* intelligence were sharpened in a battle with the rival theory—the so-called 'faculty theory'.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

cores I have described. I shall consider this view in detail and show why it is mistaken later.[1] Readers will be able to judge whether research on intelligence truly constitutes *two* research programmes with different hard cores and different heuristics when I come to describe the actual research in section 2 and in section 3 which will appear as Part II in the next issue of this *Journal*.[2]

Logically the hard cores of both programmes are all-some statements and they consequently have no potential falsifiers.[3] Falsifiable versions can only be generated by conjoining them with some auxiliary, 'protective belt', hypotheses.

Thus the hereditarian hard core in itself has no empirical content and it only gains predictive power when it is embedded in a particular theory of inheritance. Galton and his student Karl Pearson held to the blending theory of inheritance[4] but at least since Fisher's seminal studies around

[1] *Cf. below*, pp. 110–11.

[2] Although, as I shall argue in section 1(*c*), the private beliefs of scientists are not relevant to an objective description and appraisal of their research, some researchers in the field of intelligence have articulated the hard cores of the programmes on which they work.

Consider first the hereditarians. For example, Galton expresses himself uncompromisingly: 'I have no patience with the hypothesis occasionally expressed and often implied, especially in tales written to teach children to be good, that babies are born pretty much alike, and that the sole agencies in creating differences . . . are steady application and moral effort. It is in the most unqualified manner that I object to pretensions of natural equality' (Galton [1869], p. 14). Cyril Burt characterises intelligence as follows: 'First, it is a *general* quality; it enters into every form of mental activity; secondly, it is (in a broad sense of the word) an intellectual quality—that is, it characterises the cognitive rather than the affective or conative aspects of conscious behaviour; thirdly, it is inherited or at least *innate*; differences in its strength or amount are due to differences in the individual's genetic constitution' (Burt [1955], p. 163). Burt also conjectures that 'most psychologists believe that differences in intelligence are innate . . . because of the vast mass of converging evidence' (Burt [1943], p. 89).

Let us now cite some environmentalists. One of the earliest explicit statements of the main tenet of environmentalism was made by Descartes. He writes: 'the power of forming a good judgment and of distinguishing the true from the false, which is properly speaking what is called Good sense or Reason, *is by nature equal in all men*'. He adds modestly that 'I have never ventured to presume that my mind was *in any way* more perfect than that of the ordinary man' (Descartes [1637], p. 82; my italics). More recently, J. B. Watson ([1931], p. 270) claimed that 'all healthy individuals . . . start out *equal*' and he also declared: 'Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in, and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief, and, yes, even beggar-man or thief, regardless of his talents, penchants, tendencies, abilities, vocation, *and race of his ancestors*' (*ibid.* p. 104; my italics). In a U.N.E.S.C.O. statement of 1950, a group of sociologists and anthropologists assert that 'given similar degrees of cultural opportunity to realise their potentialities, the average achievement of members of each ethnic group *is about the same*. The scientific evidence of recent years *fully support* the dictum of Confucius . . . [that] "men's natures are alike; it is their habits that carry them far apart" ' (U.N.E.S.C.O. [1950]; my italics).

[3] *Cf. e.g.* Watkins [1958], pp. 345–8; but *cf.* Lakatos [1970], pp. 144–5.

[4] According to the blending theory of inheritance, the characters of a child are always a blend of the characters of its parents. This theory implies that successive generations would display diminishing variation in all inherited characters, a prediction which was

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

1918[1] the hereditarian programme has assumed that intelligence is inherited by the multifactorial mechanism. The multifactorial theory of inheritance asserts that characters showing continuous quantitative variation are determined by a large number of genes which segregate in accordance with Mendelian principles and which each produce a small, similar and cumulative effect.

Even when conjoined with the multifactorial theory, the hereditarian programme's hard core makes no claims about the relative intelligence of any particular pair of individuals (unless they happen to be monozygotic twins) or of any two racial or social groups. Instead, the programme makes *statistical* predictions concerning the values of correlations for intelligence between large numbers of pairs of variously related persons.

On the other hand, the environmentalist programme is much 'bolder', in Popper's sense. Unlike its rival, it does not lead merely to statistical predictions but asserts that *every pair* of individuals inherits identical innate mental capacities. Thus, the environmentalist programme enables us to make predictions concerning phenomena about which the hereditarian programme has not been able to make any. For example, the environmentalist programme anticipates that all social and racial groups will have identical grades of intelligence while the hereditarian programme is completely agnostic about the relative average intelligence of different groups.

Now both research programmes make predictions concerning inherited mental capacities and in order that these predictions may be tested, it is necessary that instruments be devised which will measure these capacities. Such instruments have become known as IQ tests.

In assessing the methodological role of IQ tests in each of the research programmes, thermometers provide an instructive analogy, for the relationship of thermometers to thermodynamics is rather similar to that of IQ tests to theories of intelligence. Since thermodynamics is a theory about heat, it requires thermometers in order that its predictions may be empirically tested. However, the development of reliable thermometers took several centuries and even today we do not have any *perfect* thermometers. Particular difficulty was encountered when trying to devise thermometers which would accurately measure extremes of temperature. Under such extreme conditions, some auxiliary assumptions on which conventional thermometers were based, such as the linear proportionality between

---

controverted by the facts. Darwin tried to resolve the anomaly by postulating the spontaneous development of new variations. But this was a sadly *ad hoc* move and the anomaly was not resolved progressively until the rediscovery of Mendel's theory around 1900.

[1] Fisher [1918].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

change in heat and the volume of the thermometer fluid, had to be abandoned. Such auxiliary assumptions form part of the 'protective belt' of the thermodynamics programme and they are accepted if they are 'progressive', that is independently testable and corroborated, otherwise they may be discarded.

In constructing IQ tests, various auxiliary assumptions are made. For example, it is assumed that the cultural content of the questions in the test is equally familiar and significant for all potential subjects. Each of the programmes then uses the resulting IQ tests to check its respective predictions concerning general intelligence. If any predictions are not confirmed, then researchers frequently replace some auxiliary assumption which had been taken for granted when the test was constructed and in this way they try to improve their tests. Such techniques constitute the *heuristic* of the two programmes.[1]

It is clear now why I put 'IQ debate' in inverted commas in the title of my paper. To call the controversy the 'IQ debate' is like calling the rivalry between two theories of heat the 'thermometer debate'. The misnomer is due to the strong operationalist influence among scientists, some of whom believe, falsely, that science is about what measuring instruments measure. But acceptance of operationalism precludes any explanation of how one measuring device is better than another.[2]

(*b*) *The Positive Heuristics of the Two Programmes.*

Each of the programmes has developed manoeuvres which are employed to resolve anomalous test results and which guide the construction of improved IQ tests.

The *heuristic of the hereditarian programme* has developed considerably since its main tenets were set out by Galton. In its present form it contains R. A. Fisher's techniques for analysing variance, the machinery of factor analysis developed by Spearman, Burt, Thurstone and others and at least two methodological directives.

First, the heuristic directs hereditarians to construct ever-improving tests of 'general intelligence' and to check these tests by using them to measure the IQ's of people whose genetic relations are known from Mendelian theory.[3] If these tests do not yield the predicted pattern, then

[1] *Cf. below*, section 1(*b*).

[2] For a good criticism of operationalism, *cf.* Zahar [1973].

[3] The hereditarian heuristic originated with Galton in whose work we find the first attempts to measure intelligence. In these pioneering attempts, the appraisal of intelligence involved judging a person's 'eminence' by surveying his biography. (*Cf. below*, p. 115, footnote 1.) In order to show that differences in intelligence arose from inherited differences, Galton, guided by the blending theory of inheritance, tried to demonstrate

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

the hereditarian first blames the test. The test is declared 'badly administered'. For example, it may be conjectured that the subjects were not put sufficiently at ease during the test.[1] If no such assumption succeeds in dissolving the anomaly, the test is declared 'culture biased' against some people, in other words it is said to favour those people who possess some specialised knowledge or experience. In order to test this assumption, a new test must be employed (or specially constructed) which can be seen to exclude the putative unfair cultural element. One can, of course, introduce more substantial changes in order to account for anomalies.

For instance, one may change the underlying theory of inheritance as applied to intelligence.[2] (One might even invent a radically new theory of intelligence and replace the most basic ingredients of the background knowledge which had supported the research programme. A revolution in gene physiology may well make us discard both rival research programmes, but such major creative innovations will hardly be triggered off by mere anomalies in the relatively small hereditarian programme. It is however logically possible for hereditarians to dissolve anomalies by appealing to profound environmental effects which influence the genes or which hamper their normal action. Such anomaly-resolving techniques are not employed in the hereditarian programme. No doubt, this is simply a result of the fact that no satisfactory theories describing the chemistry and physics of 'intelligence genes' are available. When such theories come forward, the present day controversies are likely to take radically new forms.)

New tests are generally constructed, not in response to anomalies but in order to extend their scope, for example, to entirely different cultures or to handicapped children. The most ambitious efforts along these lines have involved attempts to construct 'ideal' IQ tests which are completely

that the closer two people are related, the more similar they are in qualities of 'eminence'. He also invented experimental methods in an attempt to discriminate between hereditarian and environmentalist theories current in his day. For example, he was the first to propose the study of twins and of adopted children. (*Cf.* Galton [1883] and [1889].) He was aware that such crude and subjective assessments of intelligence were, at best, first approximations. The development of objective measures of native intelligence was a natural part of his research programme. For Galton, the aim of objective mental tests was 'to obtain a general knowledge of the capacities of man by sinking shafts, as it were, at a few critical points' (Cattell [1890], footnote inserted by Galton).

[1] *Cf. e.g.* Jensen's explanation of some alleged increases in children's IQ's in programmes for compensatory education, *cf.* below, section 3 (*c*) (in Part II).

[2] This course was adopted by Karl Pearson in the early days of the hereditarian programme when he reverted to the blending theory of inheritance after his sibling correlations for 'ability' and stature failed to conform to the predictions of the multifactorial theory. This was an *ad hoc* manoeuvre. The failure of IQ's to follow a normal curve over the whole range of IQ's also led some researchers to modify slightly the multifactorial theory of inheritance as applied to intelligence. This manoeuvre was not *ad hoc*. (*Cf. below*, pp. 128–30.)

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

culture fair, in so far as they require no knowledge of any particular culture but depend on physiological responses.[1]

There is a second methodological directive in the hereditarian heuristic, namely to compare the intelligence of different groups and to investigate the relationship between intelligence and important social phenomena.[2]

Comparisons of the intelligence of different groups may throw light on some important sociological phenomena since if two ethnically similar but geographically or socially displaced groups are found to have different average IQ's, hereditarians (if they do not invoke the culture bias of the tests) may adopt the auxiliary assumption that one of the groups was derived from the genetically more intelligent members of the original group by *selective migration*.[3]

The *heuristic of the environmentalist programme* contains the directive to search for the *environmental* factors which bring about differences from original intellectual equality. Whenever a test of intelligence, which is initially assumed to be 'culture fair' yields individual or group differences, environmentalists account for these differences by conjecturing that the 'less able' subjects had been exposed to one or more (previously hidden) deleterious experience or had been deprived of some (previously unrecognised) environmental stimulus. (The effect which the environmental factor has on a particular individual may be reversible or irreversible.) In order to test such conjectures, the environmentalist may either repeat the same IQ test on individuals who are equal in regard to the *specified* factor or he may assume that the test was culture biased after all and change the test material so that the guilty environmental factor is excluded from it. The conjecture will be confirmed if the individuals now gain more nearly equal scores. By identifying specific environmental factors which affect performance on intellectual tasks and by compensating for them, the

[1] Galton and Cattell made the earliest such attempts by trying to measure intelligence *via* the sensory motor functions. (*Cf.* Cattell [1890].) These efforts were, however, abruptly abandoned when it was discovered by Wissler (*cf.* his [1901]), using the method of correlation newly introduced by Pearson, that no correlation at all existed between such measures and intuitive notions of intelligence. (The importance of intuitive notions of intelligence as points of departure for both programmes is discussed *below*, p. 108.) More recently, researchers have had some success along these lines by finding very high correlations between the results of standard IQ tests and certain quantities connected with the 'evoked potential' produced when the brain receives a sudden physical stimulus. (For a review of these investigations, *cf.* Eysenck [1973], pp. 78–81.)

[2] Although the 'IQ debate' has tended, at least in popular expositions, to centre round the issue of social class and racial differences, many other interesting social phenomena come within the purview of the two programmes. For example, a possible link between criminality and intelligence could be investigated. Such studies were envisaged by Binet in the earliest days of mental testing. *Cf.* Binet and Simon [1905*b*], p. 246 (quoted in Wolf [1969], p. 215).

[3] *Cf. e.g.* the hereditarian explanation for the origins of social class differences in average IQ score, *below*, pp. 122–5.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

environmentalist programme aims to construct tests on which all environmentally equal subjects gain the same scores.

From my description of the heuristics of the two programmes it is apparent that there is considerable (but by no means complete) overlap between them. The heuristics differ most importantly in that, because of their different hard cores, they make different predictions concerning the distribution of intelligence and hence they recognise different events as anomalies. The two programmes, however, share the common aim to construct tests of general intelligence which tap *inborn capacities* rather than acquired skills. Hereditarians and environmentalists share crude and intuitive ideas about the nature of cognitive capacity, in contradistinction to acquired skills and in contrast with emotional reactions. Various intuitive notions of intelligence have been articulated by environmentalist and hereditarian researchers. For example, intelligence has been characterised as 'good sense or reason' (Descartes [1637]), the ability 'to judge well, to understand well, [and] to reason well' (Binet 1905*a*]), 'the ability to educe relations and correlates' (Spearman [1927]), 'the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment' (Wechsler [1944]), and as 'problem-solving ability' (Davis [1949]).

Some critics allege that the fact that researchers have been unable to characterise intelligence more precisely constitutes a fatal weakness in their programmes. But they are wrong. It is common in science for initially vague concepts to attain an improved and more precise formulation by being embedded in a growing research programme. For instance, heat, mass and force, once primitive, undefined ideas, were modified and given precision within developing thermodynamics and dynamics. Just as 'intelligence' is sometimes derided as being 'meaningless';[1] the concept of force acting at a distance was regarded by some seventeenth-century critics as 'occult'. In appraising whether the initially intuitive concepts of intelligence are *sterile* or *fertile*, it will be necessary to see whether they have been incorporated into degenerating or progressive research programmes. This task of appraisal will be carried out in sections **2** and **3**.

(*c*) *Should Scientists Believe the Hard Cores of Their Programmes?*

It will no doubt be objected that, in setting up rival hereditarian and environmentalist positions, I have grossly misrepresented the debate since few of the scientific protagonists actually *believe* either of the hard cores of the two research programmes. Now it is certainly the case that many environmentalists and hereditarians would not declare belief in the hard

[1] *Cf. e.g.* Maddox [1957].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

cores of their respective programmes, although some do.[1] But the private, psychological beliefs of scientists have no place in an appraisal of their work. What must be considered in describing their research are the heuristic principles which they follow *in practice*. It is perfectly possible for a scientist to work within a research tradition without *believing* that the assertions about the world on which the tradition is based accurately reflect reality. Take P. E. Vernon, for example. He declares that he is 'not sympathetic to the view that intelligence itself is an innate quality and that our tests are inefficient at measuring it because they are subject to environmental influences'.[2] Yet in the same paper from which this quotation is taken, Vernon attempts to show how *all* of the alleged increases in the IQ's of some 'feeble-minded' children reared in special environments can be traced to the inadequacies of the tests themselves or to the way in which they were administered. Caldwell is an example of a researcher who follows the heuristic of the environmentalist programme despite the fact that she 'pays lip service' to the existence of genetic differences in intelligence. She says: 'most of us in enrichment efforts [that is, attempts to increase IQ's by compensatory education[3]]—no matter how much *lip service* we pay to the genetic potential of the child—are *passionate believers* in the plasticity of the human organism. We desperately need to believe that we are born equalisable. With any failure to demonstrate the effectiveness of compensatory experiences offered to children of any given age, *one is entitled to conclude parsimoniously that perhaps the enrichment was not offered at the proper time.*'[4] Lakatos mentions Newton and Planck as examples of physical scientists who worked on research programmes whose hard cores they did not believe in[5]; another important example is Maxwell in his early work on kinetic theory.[6] It is certainly true that the research in the field of intelligence can be divided into that which is carried out according to the hereditarian and environmentalist heuristics as I have described them. The only way I can see of attaching these heuristics to claims about the world is by associating them with assertions equivalent to those I have characterised as comprising the respective hard cores. It has, however, to be emphasised strongly that the progress and degeneration of a research programme are logically independent of the scientist's degree of belief in or commitment to its hard core. I conjecture that, *at least in the past, the extent to which scientists' psychological beliefs used to approximate to the hard cores of their own programmes is positively correlated with how objectively progressive these programmes were*. A classical corroboration of this

[1] *Cf. above*, p. 103, footnote 2.
[2] Vernon [1951], p. 136.
[3] *Cf. below*, section 3 (*c*) (in Part II).
[4] Caldwell [1968], p. 81; my italics.
[5] Lakatos [1970], p. 144–5.
[6] *Cf.* Brush [1965], pp. 26–7.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

conjecture is the early scepticism of Newtonians concerning their principle of 'action at a distance' in contrast with the dogmatism of later Newtonians. Another example is the scepticism of early Copernicans, like Osiander, towards the hard core of their programme, and their increasing belief in it as its progress became overwhelming.[1]

Before proceeding from the *description* of the two rival programmes to their *evaluation*, I would like to counter one standard counterargument. According to some psychologists, research on intelligence must be represented by *one single research programme* and not by *two* rival programmes. Eysenck, who puts this view most clearly, suggests that there is *only one single programme* which he calls the '*interactionist*' programme and whose main tenet is that 'genetic factors, interacting with environmental ones are active in producing the observed . . . differences'[2] and the task of the interactionist is 'to *find out* the relative importance of these factors'.[3] Indeed, Eysenck argues for the much stronger position that 'interactionism' is 'the only tenable view'[4] since, he maintains, 'a purely hereditarian . . . [theory] which would account for *all* the observed phenomena [that is, IQ differences] in terms of genetic factors alone . . . would run foul of the most elementary tenets of genetic science, with its stress on the difference between genotype and phenotype'.[5] But although Eysenck insists that the *possibility* that all IQ differences are caused by genetic differences is ruled out on theoretical grounds, he does not specify exactly what percentage of IQ differences we may legitimately consider to be genetic in origin without violating 'the tenets of genetic science'. Nor could he. The truism that there can be no phenotype unless the genotype comes into contact with an environment does not preclude the *possibility* that the differences in a particular phenotype might be exclusively the result of differences in genotype.

Now Eysenck's 'interactionism', with its objective of 'finding out' the relative importance of hereditary and environmental factors in producing IQ differences is not a research programme at all, any more than an exercise in 'finding out' the chemical composition of a particular sample of air would constitute a research programme. Eysenck's view may accurately

[1] Lakatos predicted that one major future branch of psychology will concern itself with causal relations between the world of objective ideas (Frege's and Popper's 'third world' of ideas; *cf.* Popper [1972], chs. 5 and 6) and psychological and even moral factors. For instance he conjectured that protagonists of degenerating research programmes tend to succumb to moral degeneration. (Private communication.) This is a more specific version of a prediction made by Popper in his [1972] (p. 156).

[2] Eysenck [1971*a*], p. 115.

[3] *Ibid.*; my italics.

[4] Eysenck [1973], p. 29.

[5] Eysenck [1971*a*], p. 115.; my italics.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

describe the checking of *a particular intelligence test* but it overlooks the vital fact that hereditarians, for example, do not meekly acknowledge that there are environmental influences on intelligence when evidence for such influences is presented but, guided by the heuristic of their programme, they usually invent some auxiliary hypothesis which makes the anomalous result consistent with hereditarian theories. The task of the methodologist is to assess whether these auxiliary hypotheses are *ad hoc* or not and hence whether the programme in which they figure is progressive or degenerating.

There is, however, some truth-content to Eysenck's thesis, namely that all research programmes are anomaly-ridden, all hard cores are likely to be false and normally each of any two rival programmes has a grain of truth in it. But the methodology of scientific research programmes is basically conventionalist and hence fallibilist and while it recognises the impossibility of comparing the *truth-content* of rival theories it claims to be able to appraise the empirical success of different problem-recognising and problem-solving machinery.

(*d*) *The Theory of General Intelligence* versus *the Faculty Theory.*

Galton was the first to propose that individuals possess a *general* intellectual ability which threads the whole range of their mental abilities, as well as some special aptitudes of lower generality. According to Galton's theory, people can be arranged in a '[*linear*] continuity of natural ability'.[1] He adduced some anecdotal evidence to show that great men of science owe their eminence much less to special powers than to the concentration of their general giftedness in some particular direction.[2]

Galton's theory was in sharp contrast with the rival *faculty theory* of the intellect which was especially championed in this century by Thorndike, Kelley and Thurstone.[3] The faculty theory *denies* the existence of a general intellectual factor and asserts instead that the intellect is composed of many *independent faculties* such as mathematical, mechanical and verbal faculties. The faculty theory predicts that people can only be arranged multi-dimensionally into qualitatively different types possessing different strengths of different faculties.

The two theories were made testable by Charles Spearman and others who imported precise statistical techniques into the debate. Spearman pointed out that if general intelligence exists, then all tests of mental ability should be positively correlated.[4]

Indeed, Spearman's suggestion was carried out and the observations favoured the theory of general intelligence. When the scores gained by

[1] Galton [1869], p. 26. [2] *Ibid.*, p. 22.
[3] *Cf.* Thorndike [1925], Thurstone [1938] and Kelley [1928]. [4] Spearman [1904].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

people on a large number of diverse mental tests are intercorrelated, the correlations are pair-wise positive as predicted by the theory of general intelligence. For example, high correlations exist between such apparently diverse activities as vocabulary tests, discovering the shortest way out of a printed maze, memorising digits and copying designs.[1]

Thurstone, however, attempted to demonstrate in his [1938] that this is not so and that evidence corroborated the faculty theory. He devised 56 tests of 'primary mental abilities' and analysed the scores which 240 students gained on them. Using a refinement of the method of factor analysis, developed by Spearman, Thurstone extracted eight apparently independent 'primary mental factors' which he characterised as verbal, perceptual speed, inductive reasoning, word fluency, number, rote memory, deductive reasoning and spatial abilities.

The apparent absence of a general factor common to all of Thurstone's tests was a corroboration for the faculty theory, but the victory was short-lived. Within months, Spearman and Eysenck had 'reworked' Thurstone's data and demonstrated that a general factor did exist and had been suppressed merely by the application of a specially chosen statistical procedure.[2] The main reason why the general factor could be so easily concealed in Thurstone's results was that he used subjects whose range of ability was very narrow. On repeating the experiment with children representing a wider spectrum of ability this general factor was much more prominent and could no longer be eliminated by the statistical methods Thurstone had originally employed.[3] Although Thurstone played this general factor down and dubbed it a 'second order factor',[4] most contemporary researchers (whether hereditarian or environmentalist) now accept the theory of *general* intelligence.

The principles used in attempts to construct intelligence tests are dictated by the theory of intelligence adopted. This may be illustrated by comparing some of the *desiderata* which the faculty theory and the theory of general intelligence impose on intelligence tests.

[1] Actually, Spearman advocated the much stronger thesis than the theory of general intelligence I have described. This is the so-called 'two factor theory' according to which an individual's performance on all *diverse* mental tests can be divided into a general factor (general intelligence) threading *all* tests of intellectual ability and a second factor *specific to each separate test*. Thus Spearman denied the existence of any special factors of lower generality than general intelligence which are common to sub-groups of diverse mental tests. (*Cf. e.g.* Spearman [1904].) When evidence for such special factors was discovered among such diverse tests, Spearman resorted to the sadly *ad hoc* assertion that the tests were not *really* diverse. (Spearman [1927].) Thus Spearman's strong theory has degenerated. However, as I have shown, the weaker version of his theory, which postulates the existence of general intelligence, has progressed.

[2] Spearman [1939] and Eysenck [1939].

[3] Thurstone and Thurstone [1941]. *Cf.* also Eysenck [1973], pp. 52–6, for a discussion of Thurstone's programme.

[4] Thurstone [1948].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

According to the faculty theory, human aptitudes consist of several independent faculties and intelligence is some kind of combination of these. The ideal intelligence test should consequently contain test items which (*a*) correlate highly with an external criterion of intelligence and (*b*) correlate negligibly amongst themselves. The latter consideration is necessary because if two tests are correlated then they are measuring the same entity to some extent, and to that extent they are repetitive. However, attempts to find test items which satisfy these two *desiderata* have been unsuccessful[1]: the faculty theory has degenerated.

According to the theory of general intelligence, there are quite different *desiderata* on intelligence tests. According to this theory, an intelligence test should contain a large number of 'diverse' items covering as many different subject matters and using as many different types of test material as possible. In addition, the correlations of the items with one another should be high. These two *desiderata* for suitable test items ensure that when the scores gained on each item are added up, the effects of special aptitudes and specific factors which each of them inevitably involves is minimised and the effect of the general factor is maximised.[2] Some attempts to construct tests which satisfy the *desiderata* imposed by the theory of general intelligence were successful, indicating progress in the programme.[3]

[1] The psychologists involved in constructing the Army Alpha test tried to construct it from the point of view of the faculty theory but they failed and they fell back on the theory of general intelligence. *Cf.* Yerkes [1921], pp. 316 and 338, and also Freeman [1939], pp. 250–3.

[2] In addition there are various practical considerations which are taken into account when constructing intelligence tests. The most important of these are that the tests are susceptible to easy and objective marking. It is also desirable that the test be available in alternative but equivalent forms so that the effect of coaching and different conditions on the test scores can be investigated. Also standard procedures for administering the test must be worked out. *Cf. e.g.* Terman and Merrill [1937] and Warburton [1969].

[3] The correlation between the scores which a group of people gains on mental tests *a* and *b*, r_{ab}, is related to the correlations r_{ag} and r_{bg} which these tests have with hypothetical tests of general intelligence (*g*) by the relation

$$r_{ab} = r_{ag} \times r_{bg} \qquad (1)$$

The hypothetical correlation r_{ag} is called the 'loading' of test *a* on general intelligence; or its g-loading. The g-loadings of *n* mental tests are found by a trial and error method from the $n(n-1)$ observed intercorrelations of these *n* tests with each other. (*Cf. e.g.* Vernon [1950].) The degree to which an IQ test measures differences in general intelligence is often estimated by averaging the *g*-loadings of its constituent tests; using this procedure, most IQ tests are found to have *g*-loadings in excess of 0.7. But this procedure of averaging the *g*-loadings of the constituent tests surely underestimates the loading of IQ tests on general intelligence; it takes no account of the prediction that combining the scores which people gain on many diverse tests maximises the factor common to them all, namely *g*, and minimises factors specific to sub-groups of tests. A more satisfactory estimate of the *g*-loadings of IQ tests may be obtained by using relation 1 in the following manner: the *g*-loading, r_{vg}, of the vocabulary test in the Stanford–Binet IQ test is about 0.8 and the correlation, r_{vI}, of the vocabulary test with the IQ test of

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

Note. The first successful intelligence tests were developed by Binet and Simon in France in 1905. As early as 1895, Binet had criticised Galton's and Cattell's attempts to measure intelligence *via* the sensory motor functions. Binet claimed that while elementary psychological processes such as reaction times can be measured with considerable accuracy, intelligence is more likely to be related to higher mental functions, where individual differences are larger.[1] Binet's early experiments were with tests such as those for memory of designs, making up sentences to include specific words, and indicating how two concepts were alike and how they differed. His major criteria for a good test of mental ability were that it should distinguish bright from dull children and that older children should find it easier than younger ones. In addition, he was guided in the selection of test items by his view of intelligence as the quality which enables a person 'to judge well, to understand well, [and] to reason well'.[2]

In 1904, Binet was appointed to a special commission whose task was to recommend methods for the early diagnosis of sub-normal children so that they could be allocated to special schools. In his attempt to find a satisfactory diagnostic test, Binet made the discovery that the scores gained by children on a *combination* of several tests correlated with age and with primitively judged intelligence much better than did each individual test.[3] This was a major empirical success for the theory of general intelligence.

For Binet, a child's intelligence was given by the difference between his mental age and his chronological age. Mental age is defined as follows: when a child's performance on an IQ test and the performance of an average child in a particular age group are similar, the child has a mental age equal to the chronological age of that group. The intelligence quotient, or IQ, which was introduced into the 1916 Stanford revision of the Binet scale[4] is the ratio: $\frac{\text{mental age}}{\text{chronological age}}$. IQ has the advantage over mental age as a measure of intelligence that a particular IQ value represents the same degree of mental retardation at every age. But since mental age levels out at about the age of 15, the ratio of mental and chronological ages is not a suitable measure of intelligence for adults. IQ is now usually given by the ratio of the raw score gained by an individual on a test and the score gained by an average individual of the same chronological age. The tests are standardised so that at each age level, the scores gained by a representative sample of people are approximately normally distributed with a standard deviation of 15 and an average score of 100.

---

which it is a constituent is also about 0.8. By relation (1), the *g*-loading, r_{ig}, of the Stanford–Binet test is about unity. (Strictly speaking, the correlation of the vocabulary test with the score on the *remaining* part of the IQ test should be used in relation (1). But since the vocabulary test contributes as little as 5 per cent to the score on the overall test, the more rigorous approach would produce no significant difference. *Cf.* McNemar [1942], pp. 138–9.)

[1] Binet and Henri [1895].

[2] Binet and Simon [1905*a*], p. 196.

[3] For a discussion of Binet's achievement see Wolf [1969].

[4] The Binet scale was revised by Terman and his co-workers at Stanford University in 1916, 1937 and 1960. The revised scales became known as the Stanford–Binet intelligence tests. *Cf.* Terman [1916] and Terman and Merrill [1937] and [1960].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

2 THE PROGRESS OF THE HEREDITARIAN PROGRAMME

(*a*) *The Inheritance of Intelligence.*

The hereditarian programme predicts that general intelligence is inherited. Thus it predicts that there is a positive correlation for intelligence among members of the same family, the size of the correlation being greater the closer the kinship.[1] In particular, the hereditarian programme makes specific predictions concerning the magnitudes of these correlations.

The values predicted by the hereditarian programme for correlations in intelligence of variously related individuals are calculated on the basis of the multifactorial theory of inheritance using statistical techniques largely due to Fisher.[2] The multifactorial theory of inheritance is background knowledge for the hereditarian programme. It asserts that inherited characters showing continuous quantitative variation are determined by a large number of genes which segregate in accordance with Mendelian principles and which each produce a small, similar and cumulative effect. Formulae giving the required correlation coefficients can be derived.[3] Each of these formulae is a function of two parameters which correspond to the effects of partial dominance and assortative mating. The parameter for assortative mating is the correlation for intelligence between parents and it may be directly measured. The parameter giving the degree of dominance may be read off from one of the correlations actually observed or it may be chosen to give the best agreement between all of the observed

[1] Galton pioneered studies of family similarities in mental qualities. In his most celebrated study, Galton showed that the 100 'most eminent' members of 100 families had 'eminent' relatives in the following numbers: 31 fathers, 41 brothers, 48 sons, 17 grandfathers, 18 uncles, 22 nephews, 14 grandsons, 3 great-grandfathers, 5 great-uncles, 13 first cousins, 10 great-nephews, 3 great-grandsons and 31 other more remote relatives. Galton sought to show that his results were inconsistent with a purely environmental interpretation by pointing out the existence of 'two classes of men with equal advantages in one of which they have high hereditary gifts while in the other they have not'. He also pointed out that current environmental theories could not account for the fact that many brilliant men, such as Newton, D'Alembert, Gauss, Laplace, Whewell, Mill, Faraday, Kant and Kepler were the sons of poor peasants or artisans (Galton [1869]).

[2] While early Mendelian theory could explain qualitative, discrete differences in terms of single gene pairs, it could not account for the types of continuous variation encountered by biometricians. Karl Pearson, a pupil of Galton's found a correlation of about 0.50 between pairs of siblings for various physical traits such as eye colour, height, colour of hair and cephalic index and a similar correlation for 'psychical' characters such as teachers' ratings of 'vivacity' and ability. Pearson argued that since the physical and psychical traits gave similar correlations for siblings they are both inherited. The observed value of 0.50 was however much higher than the theoretical value calculated on the basis of Mendelian theory. Pearson consequently *rejected* Mendelian theory and fell back on the old blending theory of inheritance. (*Cf.* Pearson [1904].) The inconsistency between the measured correlations for graded characters and those predicted by Mendelian theory was resolved by R. A. Fisher in his [1918] using the multifactorial theory of inheritance.

[3] *Cf.* Burt and Howard [1956].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

and theoretical correlations. A consequence of this procedure is that one of the correlations for intelligence cannot be counted as being a prediction.

The data set out *below* in Table 1 are the correlations measured for pairs of variously related individuals. The data summarise correlations obtained on more than 30,000 pairs of individuals in over fifty separate studies carried out in eight countries. Most of the kinship correlations were obtained using very large groups although a notable exception is the rare category of monozygotic twins separated shortly after birth where a total of 122 pairs have been examined. The three kinships which have been investigated in a single study only[1] are second cousins (127 pairs), uncle or aunt and nephew or niece (161 pairs) and parents (as children) and their children (106 pairs). The results obtained experimentally are compared with those predicted on the assumption that the environment played no role at all in determining IQ's.

The theoretical values for the correlation coefficients for intelligence were calculated by Cyril Burt using the assortative mating parameter which he observed in his London sample. In applying these theoretical values to the correlations found for other samples, the assumption is made that there was, on average, a similar degree of assortative mating in these populations. This is a reasonable assumption since the theoretical values are rather insensitive to changes in the assortative mating parameter. (For example, increasing the value of this parameter from Burt's comparatively low value of 0.39 to 0.50, which is the value more usually found,[2] and keeping dominance the same, changes the theoretical correlation for pairs of siblings from 0.52 to 0.54.)

Some corresponding theoretical and observed correlations for stature are also set out in Table 1. The theoretical correlations for stature are estimated in the same way as are those for intelligence (that is, from the laws of genetics with the two parameters filled in).

The data presented in Table 1 show that there is a wide measure of agreement between the correlations found and those predicted for intelligence by the hereditarian programme and, in view of the large numbers of subjects involved, the agreement is highly significant. In fact the agreement between the theoretical and observed correlations is only slightly better for stature than for IQ.[3]

The correlations for IQ are compared with those for stature since the

[1] Burt [1966].

[2] For a summary of the correlations obtained for IQ between parents, *cf.* Jencks [1972], p. 272.

[3] There is also considerable agreement between observed correlations for IQ and those for finger-print ridges (a factor known to be almost entirely under genetic control). *Cf.* Huntley [1966].

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

latter character is one which has been used to test theories of inheritance and because stature is clearly not susceptible to those social-psychological and cultural influences which might be most plausibly thought to affect IQ scores.

TABLE 1

CORRELATIONS FOR IQ BETWEEN RELATIVES

Relationship	*IQ*[1]		*Stature*[2]	
	Predicted	*Observed*	*Predicted*	*Observed*
Unrelated persons				
Children reared apart	0.00	−0.01		
Foster parent and child	0.00	0.20		
Children reared together	0.00	0.24	0.00	−0.07
Collaterals				
Second cousins	0.14	0.16		
First cousins	0.18	0.26	0.18	0.24
Uncle (or aunt) and nephew (or niece)	0.31	0.34	0.30	0.29
Siblings reared together	0.52	0.55	0.54	0.54
Siblings reared apart	0.52	0.47		
Dizygotic twins (different sex)	0.52	0.49		
Dizygotic twins (same sex)	0.52	0.56		
Monozygotic twins, reared apart	1.00	0.75	1.00	0.94
Monozygotic twins, reared together	1.00	0.87	1.00	0.96
Direct line				
Grandparent and grandchild	0.31	0.27	0.30	0.32
Parent (as adult) and child	0.49	0.50	0.51	0.51
Parent (as child) and child	0.49	0.56		

[1] The values for the observed IQ's are taken from Jensen [1969], p. 49; the theoretical values are calculated in Burt and Howard [1956] and Burt [1971].
[2] Burt and Howard, *ibid.*, p. 117.

Comparisons of physical characters, such as stature, with IQ scores play some heuristic role in the hereditarian programme. If IQ's behave in some unexpected manner and if the same phenomenon is observed in analogous results for some physical character, then the hereditarian is directed to try to solve the anomaly, not by changing the intelligence test but by looking for some genetic or biological explanation. Such a move led to a successful explanation of small deviations from normality in the distribution of IQ's.[1] In fact, in the earliest days of the hereditarian programme, before any satisfactory theory of inheritance was available, the comparison of mental and physical characters played a much more important heuristic role, since physical characters such as stature provided the standard of an inherited

[1] *Cf. below*, pp. 128–30.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

character. Thus Galton, in his earliest exposition of the hereditarian position, stated that 'the general resemblances in mental qualities between parents and offspring, in man and in brute, are every whit as near as the resemblance of their physical features; *and I must leave the existence of actual laws in the former case to the matter of inference from the analogy of the latter*'.[1] Thus, using stature as an analogy, Galton predicted that native ability is distributed approximately normally in the population[2] and he confirmed that 'artistic ability' is inherited by showing that parents resemble their children in this quality and in stature to similar extents.[3]

By considering the small discrepancies between the observed and theoretical correlations for IQ scores, it is possible to estimate to what extent the IQ tests measured inherited, genetic, differences. It is found, in fact, that for the IQ tests which were used, the amount of variance in scores which is attributable to environmental and genetic factors is about 20 and 80 per cent, respectively.[4] (Included in possible environmental factors are those which operate both pre- and post-natally and also random errors of measurement.) The above estimate for the importance of heredity in determining IQ differences is based on the assumption that genetic and environmental factors make independent, additive contributions to the total variance. Jinks and Fulker, in their reanalysis of Burt's (and others') data on children reared together and apart have shown that these assumptions are independently corroborated.[5]

It is immediately obvious on examining the correlation data in Table 1 that, from the environmentalist point of view, the IQ tests employed in the investigations did not tap any *inherited* intellectual capacity since they indicate that the more closely people are related the more alike they are in their IQ scores. (This result is of course predicted by the hereditarian programme.) However, since people who are genetically related are also brought up in similar surroundings, the relative sizes of many of these kinship correlations can be explained easily within the environmentalist programme as reflections of general social and cultural differences. For example, the relative sizes of the correlations found for siblings (reared together), cousins, and unrelated children are successfully accounted for by the fact that when siblings are brought up in the same home they generally share more socio-cultural factors than do cousins, and the latter

[1] Galton [1865], p. 158; my italics.
[2] Galton [1869], pp. 31–2.
[3] Galton [1889], p. 218.
[4] *Cf.* Burt and Howard [1956], Jensen [1969] and especially Jinks and Fulker [1970]. Eysenck ([1971*a*], p. 63) notes that most of the correlation studies were undertaken using IQ tests which are less 'culture fair' than those which have been developed in recent years. He conjectures that genetic variance in individual scores on these modern tests would be higher than 80 per cent.
[5] Jinks and Fulker, *op. cit.*

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

usually experience more similar surroundings than do randomly selected people. For similar reasons, the resemblance between parents and their children in IQ score will usually exceed that between grandparents and their grandchildren.

Although the environmentalist programme can explain successfully *some* of the correlation data, taken as a whole these data constitute much greater empirical progress for the rival hereditarian programme. First, while the environmentalist theories only account for the ***relative values*** of some of the observed correlations, the hereditarian programme predicts precise quantitative values for each of the correlations and, moreover, as we have seen, the predicted values are very close to the observed ones. Secondly, among the observed kinship correlations, there are several which refute the environmentalist predictions while they confirm those of the hereditarian programme. The most striking of these refutations involve comparisons of (1) monozygotic twins brought up in different homes and unrelated children brought up together, and (2) monozygotic and dizygotic twins. I shall consider each of these refutations of the environmentalist theories in turn.

TABLE 2

Relationship	*Correlations for IQ*		
	Burt [1966]	*Newman* et al. [1937]	*Median value for several studies*[1]
Monozygotic twins (together)	0.92 (N = 95)	0.88 (N = 50)	0.87 (N > 1,000)
Monozygotic twins (apart)	0.87 (N = 53)	0.77 (N = 19)	0.75 (N = 122)
Unrelated children (together)	0.27 (N = 136)	—	0.24 (N = 251)

[1] These values are taken from Jensen [1969], p. 49.

(1) Since monozygotic twins share identical sets of genes, the hereditarian programme predicts that they possess identical degrees of inborn intelligence and hence have a pair-wise correlation for intelligence of 1.00, whether brought up together or not. On the other hand, the environmentalist programme predicts that if the twins are allocated randomly with respect to the environmental factors invoked to explain similarities between relatives, then these twins should be no more alike in their IQ scores than are unrelated children drawn at random. Table 2 contains a summary of the data obtained experimentally.

The data obtained by Burt, Newman *et al.* show that the correlations in IQ for monozygotic twins reared together are very high. In fact, the correlations are almost as high as those for IQ's measured at weekly

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

intervals of the same individuals. Also, most of the studies give correlations for monozygotic twins who were separated early in life which are only slightly lower than those for monozygotic twins brought up together. Moreover, in contrast with the environmentalist prediction the median correlation of 0.75 for separated monozygotic twins is much higher than the median correlation of 0.24 for unrelated children brought up together. Although these data apparently corroborate the hereditarian theory, the 1937 study has often been held to corroborate the environmentalist theory.[1] Environmentalist claims in this respect have rested not on the observed overall correlation, but on certain specific aspects of the results; for instance, on the fact that among the 19 twins reared apart, 3 had IQ differences of at least 17 points. The largest difference was observed for 'Helen' and 'Gladys', one of whom was a teacher with an IQ of 116 while the other, who had lived in an isolated mountain district for most of her life, had an IQ of only 92.

Such differences constitute anomalies for the hereditarian programme. Burt suggested that since the twins had markedly different educations, the predominantly verbal tests were unsuitable.[2] While this explanation could not be tested on 'Helen' and 'Gladys' themselves, it gains some support from the fact that Burt obtained significantly higher correlations between the separated twins he studied when he used non-verbal tests of intelligence.[3] As striking as the case of 'Helen' and 'Gladys' is Burt's case of 'George' and 'Llewellyn'. While 'George' took a first class degree in modern languages, 'Llewellyn' was brought up on an isolated farm in North Wales and had reading and verbal abilities typical of a child of 11. Nevertheless, the twins scored 136 and 137 respectively on the non-verbal test.[4]

Both the high correlation for IQ of monozygotic twins reared apart and the low correlation which is found for unrelated children brought up together, constitute anomalies for the environmentalist programme which have not yet been dealt with, except in an *ad hoc* way. In order to account for the first anomaly, environmentalists have assumed that the environments of the separated twins which were studied were more similar than had been assumed. Similarly, the second anomaly has been explained by positing that the environments of the unrelated children were in fact different despite their superficial similarity.[5] These assumptions can only be made testable by specifying the precise (hidden) factors which made the environments alike in the first case and unalike in the second. But this has not so far been done and the explanations are consequently *ad hoc*. The

[1] *Cf. e.g.* Halsey [1958] and Maddox [1957].
[2] *Cf.* Burt and Howard [1956], p. 123.
[3] *Cf.* Conway [1958], p. 183, and Burt [1966].
[4] *Cf.* Conway, *ibid.*, p. 186.
[5] Lewontin ([1970], p. 6) advocates both of these *ad hoc* auxiliary assumptions.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

environmentalist's task here seems all the more difficult in view of the fact that among the twins which Burt studied there was no correlation at all between the occupational statuses of the families to which each of the separated twins had been allocated.[1]

(2) One of the most striking features of the family correlations for IQ is the fact that monozygotic and dizygotic twins are so different despite the similarity of the environments which these twins experience. The difference is *anticipated* by the hereditarian programme, since dizygotic twins, like siblings, have only 50 per cent of their genes in common, on average, while monozygotic twins have identical sets of genes. In order to account for this difference within the environmentalist programme, some workers have suggested that the environments of these twins differ in several crucial aspects. For example, monozygotic twins generally spend more time in each other's company, they are emotionally closer, and they are more likely to share their friends than are dizygotic twins.[2] However, the assumption that these factors influence IQ scores significantly is refuted by a comparison of the correlations for monozygotic twins reared apart and dizygotic twins reared together. Burt found a pair-wise correlation for IQ of separated monozygotic twins of 0.87, while the values predicted for this correlation by unqualified hereditarian and environmentalist theories are 1.00 and 0.00, respectively. Now for dizygotic twins of the same sex who were reared together, the correlation observed by Burt was 0.56, which is close to the value of 0.52 predicted by the hereditarian programme. The difference in the correlation coefficients for IQ of separated monozygotic twins and dizygotic twins reared together is over four times its standard error. In order to account for this difference, the environmentalist would have to assume that the separated monozygotic twins were subject to more similar environments than the dizygotic twins reared in the same homes. But no independent evidence has ever been brought forward to support this counter-intuitive assumption.

In predicting family similarities in IQ, the hereditarian and environmentalist programmes differ in two respects. First, the hereditarian programme makes precise quantitative predictions while its rival predicts only the relative values of *some* correlations between relatives and, secondly, the two programmes make several conflicting predictions. As I have shown, each of the hereditarians' quantitative predictions is close to the values obtained experimentally and, where the two programmes make opposing predictions, in particular those regarding unrelated children brought up

[1] Burt [1966].

[2] For a sympathetic review of some IQ-determining environmental factors which allegedly distinguish monozygotic and dizygotic twins, *cf.* Anastasi [1958], pp. 287–9.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

together and related children reared apart, the hereditarians have been dramatically right while the refuted environmentalist theories were only rescued at the cost of their empirical content by *ad hoc* assumptions.

(*b*) *Intelligence and Social Class.*

(*bi*) *Filial Regression to the Mean and Social Mobility.*

The hereditarian programme predicts that the correlation for intelligence between parent and offspring will be about 0.5. (As I have already discussed, the exact value for this correlation coefficient depends on the degree of assortative mating and of dominance exhibited by the population, and these are independently measurable.[1]) Now if, as is predicted by the hereditarian programme, the variability of IQ remains constant from generation to generation, then it follows from statistical theory that if there is a parent-offspring correlation of 0.50, then children have, on average, an IQ lying mid-way between the parental IQ level and the level of the general population. Thus, fathers or mothers with average IQ's of 120 will have children whose mean IQ level is only about 110 and those with average IQ's of 80 will have children whose mean IQ is about 90. This phenomenon is called filial regression to the mean. It is typical of characters generally assumed to be largely genetically determined, such as finger-print ridges and stature.

Now consider a population divided into hypothetical social groups which are differentiated by the average IQ of their male adult members. According to the hereditarian programme, (*i*) the intelligence of the children within each social group will regress half-way towards the mean of the general population and (*ii*) the standard deviation of the children's intelligences within each group will be close to that of the general population. The hereditarian programme predicts therefore that if the frequency distribution of IQ's within each of the social groups remains constant from generation to generation, some of the children will move out of the social groups to which their fathers belong. The minimum social mobility which is required to maintain the social distribution of IQ's can be easily calculated.[2]

Now socio-economic classes are similar to the hypothetical groups just considered. It has been found universally since the earliest days of mental testing that there are significant differences in mean IQ between the various socio-economic classes.[3] Burt's studies, for example, show that when occupational classes are arranged in the order of 'the apparent difficulty of the mental processes required either to carry out the occupation

[1] *Cf. above*, p. 115. [2] *Cf.* Burt [1961*a*]. [3] *Cf. e.g.* Binet [1911], pp. 187–8.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

efficiently or to gain entrance into the occupation',[1] then the average IQ ranged from about 140 for the higher professional group to about 85 for unskilled workers.[2]

On the assumptions (*i*) that the IQ tests are perfect measuring instruments for inborn differences in intelligence, (*ii*) that the frequency distribution of IQ's within each class remains constant from generation to generation, and (*iii*) that a person's intelligence is the sole factor determining whether he will be socially mobile, Burt predicted that on average 22 per cent of children will move out of their father's occupational class.[3] The first of these assumptions is independently confirmed by the correlation data for variously related people already discussed[4] and the second is corroborated by data collected by Burt showing that over the period 1920–50 with which he was concerned the 'occupational distribution of intelligence has remained fairly constant'.[5] The third assumption is not independently supported and consequently Burt's prediction must be weakened to the assertion that the average level of social mobility is *at least* 22 per cent.[6] Now the observed amount of social mobility in England during the period considered by Burt was about 30 per cent,[7] so that in its weakened version, the hereditarian prediction is confirmed.

Now the approximate level of social mobility in England was already known when Burt deduced its minimum extent from hereditarian theory. The prediction was therefore not novel in the temporal sense. However, it was an entirely unexpected outcome of the hereditarian programme; that is, it played no heuristic role in the construction of the hereditarian theory from which it was deduced. After all, Burt's prediction would not have been any different if he had been entirely ignorant of the empirically ascertained level of social mobility. The prediction is therefore novel in the sense defined recently by Zahar.[8]

But the prediction is not important in the context of the 'IQ debate' *simply* because the observed level of mobility does indeed exceed the minimum required, for the prediction that there is at least 1 per cent mobility would have also been novel in Zahar's sense, although intuitively it would have been much less impressive. The dramatic success of the prediction of 22 per cent mobility lies in the fact that it is not only confirmed but that no non-hereditarian theory could have independently anticipated so much

[1] Burt [1959], p. 19.
[2] Burt [1961*a*] and [1943].
[3] Burt [1961*a*].
[4] *Cf. above*, section 2(*a*).
[5] Burt *ibid.*, p. 15.
[6] The level of social mobility is the proportion of people who have moved out of the class to which their fathers belong. For the purpose of his calculations, Burt divided the male population into three separate classes. Class 1 includes professional, administrative and clerical workers; class 2 includes skilled and semi-skilled workers; and class 3 includes unskilled workers.
[7] *Cf.* Burt *ibid.* and Glass [1954], p. 183.
[8] Zahar [1973], pp. 101–4.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

social mobility. This may be judged from the *ad hoc* conjectures which have been put forward by those who eschew genetic theories when explaining social mobility.

According to one influential writer on social mobility, upward mobility 'is the product of *fluidity* and opportunity, changes in the occupational distribution, as well as demographic changes, [while] downward mobility is also a product of these factors, but here *social fluidity* is the more important'.[1] This hypothesis is, however, robbed of most of its empirical content in a footnote where the term 'fluidity' is defined as 'the ease of movement from stratum to stratum in society that is not due to changes in the occupational structure'.[2] In explaining the present level of social mobility, two of the leading authorities on the subject refer to the differential fertility amongst the social classes, the changing ratio of white collar and manual jobs and to 'motivational' factors.[3] But none of these factors accounts for any important amount of mobility. Taking Glass's empirical data for social mobility in Great Britain, the differential fertility of manual and non-manual workers caused less than 5 per cent mobility,[4] and the changes in the occupational structure made no significant contribution to mobility.[5] Since the nature of the 'motivational' factors is not spelled out, their importance for mobility cannot be estimated.

It is clear then that while hereditarian theories account for most of the observed mobility in a progressive way, there is at present no satisfactory environmentalist answer to the question about the causes of social mobility.

While the successful prediction of social mobility is a dramatic novel fact for the hereditarian programme, the phenomenon of filial regression to the mean on which this prediction depends is an anomaly for the rival programme. For if class-correlated environmental factors were crucial in creating IQ differences, environmentalists could not explain why so many children of unskilled workers gain IQ's above the population average and so many of those born to 'professional' parents are below the average in IQ. In order to explain such phenomena within the environmentalist programme, it would be necessary to invoke some factors which are *negatively* correlated with social class, but so far no environmentalist has used such factors to account for the phenomenon of regression to the mean. However, Eysenck has suggested the possible explanation that upper class children, while they have all the advantages that money can buy, are deprived of those non-material factors such as intellectual companionship

[1] Miller [1960], p. 59.
[2] *Ibid.*, p. 59.
[3] Lipset and Zetterberg [1956].
[4] Glass [1954], p. 197.
[5] *Ibid.*, pp. 189–94. In contrast with several other industrial societies, the levels of upward and downward mobility in Britain are 'virtually the same'. *Cf.* Bendix and Lipset [1960], p. 289.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

and parental concern for the child's well-being which are also important in determining IQ. Lower class children, on the other hand, while they suffer the disadvantages of relative poverty, are spared the burden of parents who spend all their time at cocktail parties and European conferences and hence they enjoy those non-material IQ determinants which are lacking in upper-class homes.[1] Eysenck has expressed the view that it would be 'illogical' for environmentalists to claim both that the higher classes have higher IQ's because of their advantageous environment and to claim that regression in these groups arises from disadvantageous factors.[2] But, *pace* Eysenck, these explanations for the class distribution of IQ's and for regression are perfectly consistent so long as the *same* environmental factors are not deployed to explain *both* facts. The environmentalist may claim that children have a 'natural' IQ of about 100 and that this value is changed by certain environmental factors. In the case of middle class children, the 'natural' IQ is increased by virtue of their superior education and material environment but this increase falls short of reaching the parental level because of certain non-material factors. *The weakness of this explanation for regression to the mean is not that it is inconsistent but that it is* ad hoc. The environmentalist must assert that the material and non-material factors just happen to be balanced in such a way that on average a child's IQ regresses almost exactly half-way towards the population mean. This arbitrary adjustment of the environmental parameters would clearly be *ad hoc*.

According to the hereditarian programme, the differences in average IQ between the classes are due to genetic factors. Hereditarians assume that these differences arose through the accumulated effects of social mobility —that is, by the selective migration of the more intelligent to a higher occupational class.[3] Halsey, who advocates 'the hypothesis of near-randomness in the present social distribution of innate intelligence',[4] maintains that this theory of selective class migration is unreasonable since it predicts that there has been a significant amount of social mobility since as early as 1700.[5] Halsey, however, offered no evidence that social mobility is a novel phenomenon; but the prediction that there was extensive social mobility in the past has not been confirmed either.[6]

Nevertheless, if the social class differences in IQ are the result of the accumulated effects of social mobility, the hereditarian programme

[1] Eysenck [1971*a*], pp. 68–9.
[2] *Ibid.*, p. 69.
[3] *Cf. e.g.* Conway [1959].
[4] Halsey [1959], p. 1.
[5] Halsey [1958] and [1959].
[6] Burt does however cite some anecdotal evidence taken mainly from Galton's [1869] investigations showing that many prominent historical figures rose to high social positions from poor origins. *Cf.* Burt [1959], p. 24, and Burt [1961*b*], pp. 124–8.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

predicts that they are maintained by this process. This prediction is confirmed by the result discussed above which shows that the true level of social mobility (30 per cent) is in excess of that required to maintain the present social class distribution of IQ's (22 per cent).

The correlation between IQ and occupational class is significantly below unity and many of those in even the lowest occupational group gain IQ scores which are well above the average for the population. Herrnstein has predicted that if contemporary meritocratic ideals are fully realised and occupational class becomes more closely linked with innate ability, then the IQ differences between the classes will widen and the level of social mobility will eventually fall. One of the predicted consequences of this is that social classes will take on the character of castes.[1] This rather alarming prediction has not been corroborated.

(*bii*) *Dysgenic Effects.*

Since it had been discovered that families of low social class are on average larger than families of high social class and since it was assumed that the positive correlation between social class and IQ is genetic in origin, hereditarians have predicted that there will be a gradual lowering of the mean population IQ by about 1 point per decade.[2] However, when these predictions were tested using non-verbal tests of intelligence in a large-scale investigation of ten-year-old children in Leicester, the anticipated decline was not found. In fact, over thirteen years from 1936 to 1947 there was a small but significant increase of 1.28 points in the population's mean IQ.[3] In a similar study of the Scottish population, where verbal tests were employed, there was a rise in the population IQ of 2.28 points over the period 1932–47.[4]

Hereditarians have attempted to explain these anomalous results by three auxiliary assumptions. First, the anomaly has been ascribed to inadequacies in the tests used and Cattell suggests that there was a larger gain in mean IQ in Scotland because of the use of relatively culture biased verbal tests.[5] Secondly, it is said that the fall in intelligence was masked by an 'advance in education and test sophistication sufficient to produce an upward change in test score of about twice the magnitude of the downward

[1] Herrnstein [1971] and [1973].

[2] Cattell [1937], pp. 42–3. A decline in intelligence caused by differential rates of breeding has been predicted by hereditarians since the end of the nineteenth century and the fear of such a decline was a factor in the founding of the Eugenics Society in 1908 under Galton's presidency. In this century, many hereditarians have warned against the dire consequences of the observed differential birth-rate. For example, Cattell (*ibid.*, p. 43) predicted that if the effects of a differential birth rate are not countered 'half the population would be mentally defective' in three hundred years.

[3] *Cf.* Cattell [1950]. [4] Thompson *et al.* [1949]. [5] Cattell, *ibid.*, p. 141.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

genetic change'.[1] And thirdly it was suggested that 'the differential birth-rate (favouring those of low IQ) has been offset by differential death, celibacy, barren marriage, etc.'[2] These auxiliary hypotheses are all *ad hoc*. But there is some evidence which supports the assumption that, although the family size of the lower social groups is, as a rule, relatively high, this effect is sometimes compensated by the higher frequency of celibacy amongst those of low IQ.[3] But since these results were obtained from populations quite different from those in which the anomalous IQ increases were observed many hereditarians still regard the anomaly as unresolved.[4]

The methodology of scientific research programmes is distinguished from some other philosophies of science such as naive falsificationism and inductivism in that it allows that a programme may be progressively scientific and yet incorporate unresolved anomalies. Thus, in appraising a programme using the standards of this methodology, the crucial task is not to see whether it has run up against any anomalies—nearly all programmes are anomaly-ridden—but rather to see whether it is dramatically confirmed, that is whether it has predicted any novel facts. Galton appreciated the insignificance of anomalies and the paramountcy of dramatic confirmation when he first set out the central tenets and outlined the heuristic of the hereditarian programme. He wrote: 'Resemblance [between parents and their children in mental qualities] frequently fails where we might have expected it to hold; but we may fairly ascribe the failure to the influence of conditions that we do not yet comprehend. *So long as we have a plenitude of evidence in favour of the hypothesis of the hereditary descent of talent, we need not be disconcerted when negative evidence is brought against us.*'[5]

The small increase in the population's mean IQ over 13 years is rather easily explained in environmental terms since there has been a general improvement in prosperity in the areas concerned over this period. However, since the rise in IQ was only about 1 point while the difference in mean IQ between children of the highest and lowest classes is around 27 points,[6] this result constitutes an extremely modest success for environmentalist explanations of social class differences in IQ.

The hereditarian programme does not predict the existence of any differences between the classes in inherited intelligence. But since the assumption that IQ tests largely measure inborn differences is corroborated in the studies of correlations for IQ of relatives reared together and apart,[7] hereditarians assume that the observed class distribution of IQ's reflect, in

[1] *Ibid.*, p. 140.
[2] *Ibid.*, p. 140.
[3] *Cf.* Bajema [1963] and Higgins, Reed and Reed [1962]. Also, *cf.* Carter [1966] for a discussion of evidence relating to the effects of differential fertility.
[4] *Cf. e.g.* Jensen [1969], p. 94.
[5] Galton [1865], p. 158; my italics.
[6] *Cf. e.g.* Burt [1961*a*].
[7] *Cf. above*, section 2 (*a*).

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

the main, inherited, genetic differences. On the basis of this assumption, and using other auxiliary assumptions, the hereditarian programme makes several predictions: (*i*) there will be a certain minimum amount of social mobility,[1] (*ii*) there was considerable social mobility in the past,[2] (*iii*) the social classes will gradually take on the character of castes,[3] and (*iv*) there will be a steady decline in the population's mean IQ.[4]

As I have shown, the first prediction was dramatically corroborated, the second and third have not yet been tested and the fourth was disconfirmed. Although environmentalist theories can successfully account for the observed small rise in the average population IQ, they cannot explain the phenomenon of social mobility, nor that of filial regression to the mean. Of course, environmentalists reject the hereditarian assumption that there are any inherited intellectual differences between the classes and I shall discuss the *ad hoc* environmentalist explanations for the social class differences in IQ in section 3.[5]

(*c*) *The Distribution of Intelligence.*

The hereditarian programme predicts that intelligence is *normally distributed.* This prediction is a consequence of the assumption that intelligence is inherited by the multifactorial mechanism discussed above.[6] Since the segregation and recombination of genes is a matter of chance, the frequency distribution of the character they influence will be normal. In fact, most graded physical characters, for example stature and lung capacity, are distributed approximately normally. (As I mentioned above, Galton predicted the Gaussian distribution of native ability on the basis of an analogy with stature.[7])

The hereditarian prediction is confirmed by the fact that IQ distributions conform closely to a normal curve within the IQ range 70 to 130, a range which encompasses about 95 per cent of the population. There are, however, a significant departures from normality outside the range 70 to 130. For example, the number of children with an IQ above 160 exceeds the number predicted by a factor of more than ten[8] and the percentage of children whose IQ's lie between 20 and 50 is four times the anticipated percentage.[9]

Hereditarians have successfully explained the fact that IQ's are not quite normally distributed by the auxiliary assumption that while the intelligence of most people is determined by the combined action of a large number of genes each of which has a small effect, some extreme levels of intelligence

[1] *Cf. above*, p. 123.
[2] *Cf. above*, p. 125.
[3] *Cf. above*, p. 126.
[4] *Cf. above*, p. 126.
[5] *Cf. below*, Part II.
[6] *Cf. above*, p. 115.
[7] *Cf. above*, p. 118.
[8] *Cf.* Burt [1963], p. 182.
[9] *Cf.* Penrose [1963], p. 45.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

are the product of rare, single, recessive or mutant genes which affect intelligence in a major way.[1]

The origin of this hypothesis illustrates the heuristic role which comparisons of intelligence and stature play within the hereditarian programme.[2] The hypothesis was suggested by the fact that similar deviations from a Gaussian distribution curve were observed in the case of stature. As early as 1917, Burt argues that the elongated tail of the normal curve is due to 'the existence of a distinct species of pathological "defectives" '[3] and he says that 'for confirmation [of the theory that the observed distribution reflects the true distribution of inherited intelligence] it would be most suggestive to compare figures for physical variability'.[4]

The assumption that very low IQ's are usually caused by single, mutant or recessive genes was dramatically confirmed in a study of 271 'mentally defective' (IQ 30–68) children and their 562 siblings.[5] The hereditarian programme makes the following predictions concerning the 'mentally defective' subjects and their siblings: (*a*) the subjects will be either members of a *low* IQ 'imbecile' group or of a *higher* IQ 'feeble-minded' group, depending on whether their level of intelligence was primarily the result of single genes or whether it was determined multifactorially (as it is for the general population). (*b*) Since the intelligence of the 'imbecile' subjects is determined mainly by rare, single genes, their siblings will not usually share the same gene. Consequently, the siblings of the 'imbeciles' will have IQ's which are representative of the general population. That is, their IQ's will be normally distributed and have an average value near 100. (*c*) On the other hand, since the intelligence of the 'feeble-minded' subjects is determined in a multifactorial mechanism, they will on average have 50 per cent of their genes in common with their siblings. As a result, the siblings will have a mean IQ about mid-way between the mean population IQ and the average IQ of the 'feeble-minded' subjects.[6] (*d*) Since socio-economic status is correlated with intelligence in the general population[7] and since the hereditarian programme predicts that the intelligences of the 'feeble-minded' and of the general population are both determined by the same mechanism, the 'feeble-minded' subjects will be mainly from the lower social classes.

Each of these predictions was confirmed in the study of 'mentally

[1] *Cf.* Burt [1935], pp. 79–81.
[2] *Cf. above*, pp. 117–8.
[3] Burt [1917], p. 35.
[4] *Ibid.*, p. 31.
[5] These 'mentally defective' children were, supposedly, all those with a Stanford–Binet IQ in the 'mentally defective' range in the Bristol and Colchester areas in England. Roberts [1952].
[6] For the phenomenon of filial regression to the mean, *cf. above*, pp. 122–5.
[7] *Cf. above*. p. 122.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

defective' children. Although the IQ's of the siblings as a whole were not normally distributed, an 'imbecile' group (mean IQ about 49) had siblings whose IQ's were approximately normally distributed with a mean value close to 100, while a 'feeble-minded' group (mean IQ about 58) had siblings whose IQ's were normally distributed about a mean value of about 80.[1] Moreover, the 'imbecile' subjects came from an average cross-section of social backgrounds, while the 'feeble-minded' subjects were predominantly from the lower social classes.[2]

The fact that intelligence is distributed in an approximately normal fashion represents a dramatic victory of the hereditarian programme over rival theories. First, it contradicts the supposition which, according to Thorndike, was commonly held at the beginning of this century that the groups designated 'genius', 'normal', 'feeble-minded', 'imbecile' and 'idiot' form completely separate classes and that the distribution of ability should therefore be *multimodal*.[3] Secondly, no environmentalist theory has been able to provide anything but an *ad hoc* explanation for the normal distribution of IQ's. In order to explain this distribution, environmentalists would have to assume that there are a large number of independent environmental factors each of which makes a small contribution to an individual's final IQ score. But this assumption contradicts other theories which have been put forward by environmentalists to explain social class and racial differences.[4] In these cases, the environmental factors usually suggested as the most important are not independent, but are linked with socio-economic status. If these class-correlated factors were important, then IQ distribution curves should be skewed towards the lower end as are the curves for school attainments and incomes. According to one environmentalist, the assumption that the relevant environmental factors are independent is ruled out by sociological considerations since 'views of

[1] According to Jensen, the subjects were divided into 'imbecile' and 'feeble-minded' groups according to whether their IQ's fell below 50 or in the range 50–75 ([1969], p. 26). But in fact there was no independent means for identifying the members of the two groups and a number of those classified as 'imbecile' had IQ's above 60. Whether the subjects had been successfully separated into those whose IQ's were part of the normal distribution and those whose IQ's were mainly the effects of major, single genes depended on whether predictions (*b*), (*c*) and (*d*) were confirmed. Roberts gives the number of 'imbecile' and 'feeble-minded' subjects in the IQ ranges 30–53, 53–60, 60–8. In estimating the mean IQ's of the subjects in the two groups, I have assumed that those in the three IQ ranges have mean IQ's of 41.5, 56.5 and 64 respectively.

[2] Hereditarians have achieved no comparable success in providing evidence for a distinction at the higher end of the scale between people with normal and non-normal IQ's.

[3] *Cf.* Thorndike [1914], pp. 315–46. Terman also claims that the approximately normal distribution of IQ's is a victory for the hereditarian programme since it refutes 'the *common opinion* that extreme deviations below the median are more frequent than extreme deviations above the median' (Terman [1916], p. 67; my italics).

[4] Attempts to explain race differences in average IQ in environmental terms are discussed in Section 3 (Part II).

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

reality and values are structured [and] they hang together amongst groups of people rather than being randomly distributed'.[1]

Some environmentalists suggest that the normal distributions of IQ's cannot be counted a novel fact for the hereditarian programme since (they allege) it is not an empirical fact at all but merely a 'statistical artifact'.[2] According to this view, 'the normal distribution is a function of the particular mathematical methodology employed *and nothing else*'.[3] Another objection is that the normal distribution was (allegedly) secured by merely 'tinkering with the test material'[4] and that this (alleged) *ad hoc* rejection of test items if they did not yield the desired distribution made the normal distribution a '*foregone conclusion*'.[5] If one of these criticisms is justified, then the other is clearly redundant since if the normal distribution could be rigged by mathematical manipulation *alone*, there seems little point in 'tinkering with the test material'. Moreover, the two objections are separately unjustified. First, it is untrue that *any* distribution of IQ scores can be converted into normal form unless the number of people passing the various tests is forged. Also, if mathematical procedures *by themselves* could ensure a normal distribution, then the small deviations from normality would presumably have to be put down to a mathematical ineptitude on the part of the test constructors. Secondly, the objection that the (alleged) *ad hoc* elimination of test items made the normal distribution a '*foregone conclusion*' is also wrong, since even if researchers *had* set out to obtain a particular distribution of IQ's, there was no divine guarantee that their efforts would have been successful. As I have shown, researchers were not able to construct intelligence tests by using the heuristic rules of the faculty theory, even though they tried very hard.[6]

Nevertheless, it must be admitted that, if the prediction that intelligence is distributed normally had been confirmed by the *ad hoc* elimination of test material or after the arbitrary scaling of test scores, the environmentalist criticisms would be substantiated. For hereditarians could then only claim a victory after they had explained in a non-*ad hoc* way why the eliminated material was anomalous or why the original method of scaling had failed.

However, the prediction that intelligence is normally distributed was not confirmed in the *ad hoc* fashion alleged by environmentalist critics. Consider Binet-type tests. In these, various tests are allocated to successive 'age levels' and the child is credited with a mental age between the 'age level' at which he passes all the tests and the 'age level' at which he

[1] Swift [1972], p. 155.
[2] Lewis [1957].
[3] Daniels and Houghton [1972], p. 74; my italics.
[4] Richmond [1953], p. 228.
[5] Simon [1971], p. 67, footnote; my italics.
[6] *Cf. above*, pp. 112–3.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

fails them all. Test items passed at intervening 'age levels' contribute fractions of a year to his mental age. Now IQ tests are standardised in a trial-and-error fashion by placing test items so that for each age group the average mental and chronological ages are identical and, hence, so that the population has a mean IQ of 100. In calculating mental ages for the purpose of this standardisation, children's performances are compared with the performance of children at *successive* age levels and no assumption is made about the relative performance of children *within* a particular age group.[1] Nevertheless, it turns out that within each age group, the distribution of Binet IQ's lies close to a normal curve, as predicted by hereditarian theory.[2]

We see then that the hereditarian programme has not only successfully predicted the fact that intelligence is normally distributed, but it has also provided a content-increasing way out of a difficulty posed by small deviations from normality. In contrast, environmentalists have either denied the facts or dealt with them in an *ad hoc* fashion.

(*d*) *Racial Differences in Intelligence.*

Significant differences in the mean IQ scores obtained by members of different racial groups were first discovered in the course of an extensive investigation of American army recruits during the First World War. The particular racial difference which has attracted most attention from researchers is the approximately 15 point discrepancy in the average IQ scores of black and white Americans.[3]

According to the environmentalist programme, all racial groups have the *same* inherited abilities and hence any IQ differences must arise through some environmental factors. Attempts to provide independent evidence for this assumption will be discussed in section 3.

Hereditarians, on the other hand, consider that the observed difference in mean IQ score of American blacks and whites is largely a product of the different genetic endowments of these groups.[4]

The hereditarian programme does not predict whether any *particular pair* of racial groups will differ in their mean intelligence levels. However,

[1] For a discussion of the methods used to calculate mental ages, *cf. e.g.* Freeman [1963], p. 204.

[2] Those involved in constructing the Stanford–Binet intelligence tests state explicitly that 'no attempt was made, as erroneously claimed by some, to secure a normal distribution of the resulting IQ's. Items were chosen in such a manner that the average *M.A.* [mental age] for an age group coincided with their (*sic*) *C.A.* [chronological age]'. (McNemar [1942], p. 17.)

[3] For the most comprehensive review of the relevant studies, *cf.* Shuey [1966].

[4] Some people think that the research into the intelligence of whites and blacks constitutes two entirely separate research programmes. I shall discuss this erroneous view in section 3 (*b*) (Part II).

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

many hereditarians argue that since races commonly differ in other polygenically determined physical characters, such as stature and skin pigmentation, it is plausible to assume that there will be *some* racial differences in intelligence.[1] Indeed, from the hereditarian point of view, it is reasonable to assume that some races will differ in their mean intelligence levels. For even if all groups had been endowed *ab initio* with similar levels of intelligence, there are so many social forces, such as selective migration and selective rates of breeding and mortality, which could alter the original racial distribution of intelligence that if all groups had retained the same mean intelligence levels, hereditarians would have to make the counter-intuitive assumption that either each group had experienced these social forces in the same degree or that such forces had operated so that their overall effects had cancelled out.

In this section, I shall discuss two predictions made by the hereditarian programme with respect to racial differences in intelligence.

The hereditarian programme predicts that if two racial populations differ with respect to their average levels of intelligence, then interbreeding between the two populations will produce offspring whose average intelligence lies between that of the two groups. Methods for measuring the degree of white ancestry of individual Negroes have only recently been worked out however and no attempts have yet been made to use these methods to correlate IQ's with the degree of racial admixture.[2]

The hereditarian programme predicts that intelligence is inherited in accordance with the multifactorial mechanism in all populations. It consequently predicts that within each population, provided that there is a similar degree of assortative mating and of dominance, the correlations for inherited intelligence for siblings are the same. In particular, assuming dominance and assortative mating to be close to the values generally found in white populations, the predicted sibling correlation for both blacks and whites is close to 0.50. Now since the hereditarian programme predicts that individuals and their siblings have identical, normal distributions of intelligence, it also predicts that children will have siblings whose intelligence has, on average, regressed half-way towards the population mean. More especially, it is predicted that the siblings of both black and white individuals will, on average, regress about half-way towards their own

[1] *Cf. e.g.* Galton [1869], p. 351, Jensen [1973*a*], pp. 130–1, and Morant [1956], p. 320.

[2] Several investigations have shown that skin colour correlates positively with IQ in Negroes. But since skin colour is a rather poor predictor of the degree of mixed racial ancestry and since a person's skin colour has important social effects, these results do not constitute a satisfactory test for either of the rival IQ programmes. For a review of studies relating IQ and skin colour, *cf.* Shuey [1966], pp. 452–66 and Jensen [1973*a*], pp. 219–30.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

population means of about 100 and 85, respectively. This prediction has been corroborated.[1] When black and white children were matched for IQ, Jensen found that over the IQ range 50–150, the siblings of black children had on average an IQ 7–10 points lower than the siblings of white children. Thus, for example, black and white children matched for IQ 120 had siblings whose average IQ's were about 100 and 110 respectively. Similarly, Negro and white children with IQ's of 70 had siblings with mean IQ's of 78 and 85, respectively.

So far, no non-*ad hoc* environmentalist account has been offered for this striking result. However, there is one striking *ad hoc* theory. According to Thoday, although the data on which the different sibling regressions are based are impeccable, they 'add nothing whatsoever to the strength of the genetic [that is, hereditarian] hypothesis'[2] since it is as easily susceptible to explanation by positing the existence of a certain '*environmental factor X*' which is specific to the black population and which penalises *all* members of that population *equally*.[3] Thus, if the effect of 'environmental factor X' would be eliminated, the IQ's of all the Negroes would be uniformly increased by about 15 points and the sibling regression data for blacks and whites would be brought into line. Although he tentatively suggests some candidates for the mysterious 'factor X', Thoday provides no independent evidence whatsoever that these are relevant to the issue of IQ differences nor does he indicate how such evidence might be obtained. But for Thoday the lack of independent empirical support for a conjecture is no deficiency since he considers that 'it is not reasonable to discount these [X factors] simply because they present hypotheses difficult to test, and because some other hypothesis fits the data'.[4] It is true that both an hereditarian and environmentalist hypothesis 'fit the data'. What distinguishes these hypotheses is that the first predicted the different regression effects for black and white siblings while the second was concocted *ad hoc* after the result was already known. Any data in the world can be made consistent with any theory by invoking nameless and untested factors. *Thoday's hypothesis is completely untestable and hence completely pseudoscientific.*

(*e*) *Conclusion.*

The hereditarian programme has anticipated many novel facts. I have discussed the successful predictions (*i*) of the degree of family resemblances in IQ[5], (*ii*) of IQ-related social mobility,[6] (*iii*) of the distribution of IQ's,[7]

[1] Jensen [1973*a*], pp. 117–19.
[2] Thoday [1973], p. 419.
[3] *Cf.* Jensen [1973*a*], pp. 137–9, for a discussion of environmental factors of this type and of their *ad hoc* nature.
[4] Thoday, *ibid.*, p. 419.
[5] *Cf. above*, pp. 115–22.
[6] *Cf. above*, pp. 122–5.
[7] *Cf. above*, pp. 128–30.

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015

and (*iv*) of the differences in sibling regression for American Negroes and whites,[1] since these are the most striking examples. When the environmentalist programme has attempted to account for the novel facts produced by the hereditarian programme, it has been unable to do so except in an *ad hoc* fashion. The hereditarian programme is not free from anomalies—but in this respect it is not exceptionally placed among scientific research programmes. Anomalies are *anticipated* by a good research programme and the puzzle-solving techniques for resolving them are articulated in advance. The crucial criterion for deciding whether a programme is progressive is whether it has anticipated novel facts. By this criterion, the hereditarian programme has been scientifically progressive and has contributed to the growth of knowledge.[2]

(*To be continued*)

The London School of Economics

[1] *Cf. above*, pp. 133–4.

[2] Some people consider that on Lakatos's criterion the hereditarian programme is pseudo-scientific: I am unable to see the force of their argument. (*Cf.* Richardson and Houghton [1973], p. 160.)

Downloaded from http://bjps.oxfordjournals.org/ at University of Birmingham on June 2, 2015