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Preface of this version

Presentation

In the Spring of 1996, a new book about intelligence and education, THE *g* FACTOR, created shock waves in Britain by tracing educational failure largely to genetic deficiency in mental speed. The book, by an Edinburgh University academic, appeared after years in which educationalists and the media had played down to vanishing point the importance of inheritance in yielding individual and group differences in attainment. Britain's politically correct academics were aghast to find fast track learning and streaming urged by a psychologist (as it had been by British Labour leader Tony Blair in a major speech in February, 1996). Under pressure from self-styled 'anti-racists', the New York-based academic publishing house, Wiley, unilaterally broke its contract with author Chris Brand by de-publishing the book for 'racism.'

After years of hysterical attacks on hereditarian theorists like Cyril Burt, Hans Eysenck and Arthur Jensen, it is time to show that London School ideas continue to stand and will not be defeated by intimidation, suppression or sacking. Commended by professors of psychology at

Cambridge (England) and Austin (Texas), and in a New Scientist editorial, THE *g* FACTOR is now re-launched in a revised edition (correcting minor errors) via this page in electronic format. It is at once a textbook about IQ and a think-piece about what should be done to reverse dumbing-down in education and to help children at *all* intellectual levels. It rejects the tired educational philosophies of both conservatives and leftists and backs a new liberalism that would give children more choice. It is free of charge and may be copied -- though not altered, please.

Chris Brand (cbrand@cycad.com) invites applications from mainstream publishers willing to re-publish his book in paper format, to advertise it and to place it in bookshops. He thanks the Woodhill Foundation, USA, for helping make it possible to gift THE *g* FACTOR to the Internet community.

Preface

Some questions about intelligence are hard to answer, at least for scientists. Are people more intelligent than animals? Will machines soon be

more intelligent than people? Is good intelligence necessary for office work, for obtaining a university degree, for organising a modern family holiday, for enjoying any art that is worthy of the name, or for harnessing creatively the deeper human instincts and impulses? Or might society organize such matters so that no great intelligence was required? Could 'intelligence' retain whatever is its usual meaning if it were sharply distinguished - as some say it must be - from whatever IQ tests measure?

These are fascinating questions about intelligence; but they do not look answerable at present. For example, what tests of abilities could provide a fair method of comparison between people and animals? Humans do not fly, echo-locate or navigate by built-in magnetic compasses; and even man's closest fellow-primates do not have the capacity for propositional thought that human language provides. Assuming that intelligence is not just some general 'capacity to adapt' (which might be attributed loosely to virtually any species - cf Schull et al., 1990), it must have evolved (when it did) against the background of the radically different sensory worlds and ecological requirements of different species (see Candland, 1993, for full consideration). Recent primate research has provided a new appreciation of the capacity of apes to learn arbitrary symbols and interact with humans (Marler, 1995); but such communication is not assisted by a grammar that highlights agency and the sequencing of events. Because of such differences in faculties between species, virtually any intended test of intelligence would be 'biassed' except when the species to be compared were closely related. It is thus no wonder that Mackintosh (1988) should think that "the central task of a comparative psychology of intelligence is....to analyse the idea of intelligence - to the point where we can probably dispense with it entirely." For the 'intelligence' differences that distinguish homo sapiens from other mammals

might simply turn out to be different principally in quality from those that distinguish eagles from other birds, whales from mammals or pigs from other farmyard animals; and such an observation would rule out any useful talk of all the differences involving any single characteristic of 'intelligence'.

Human-computer comparisons are similarly problematic. Computers 'crunch' supplied numbers impressively; whereas people possess knowledge of a wide environment - and of its dangers and its opportunities for them. No current robot would have a conventional, all-round IQ as high as 2 without the help of a human guide, interpreter and button-pusher; yet a computer allowed a human operator of mediocre intelligence would easily do far better on some tests - for example, if arithmetical operations, spelling or the provision of common synonyms were required. The point is that fair comparison is only possible when the various 'testees' - whether people or animals or computers - can all make a start with the types of problem that are to be set, and when the tests sample the range of activities that the testees might be said to undertake intelligently. Animal intelligence cannot be gainsaid because of lack of symbol use; and computer intelligence cannot be proved by superlative performance at chess. Yet to assess a person's intelligence without examining symbol use or to assess a computer's abilities without considering speed of information processing would be equally unfair and strangely neglectful of important capacities.

Questions involving species comparisons cannot be answered until there are sensible and systematic ways of comparing species. Other questions about intelligence, however, are hard to answer even for man alone; and even the best-thought-out definition of intelligence cannot be guaranteed to prevail over future empirical discoveries and social changes. To work out and establish tests for a new concept of

intelligence that was unrelated to IQ would require a discovery of correlations between mental abilities that had escaped the notice of IQ's many critics for almost a century. Any such 'new IQ' would have to be expressed in a wide range of tests and tricks that correlated with each other, but not with the 'old' IQ tests. Yet such a huge change might just be conceivable as people work increasingly in tandem with computers and word-processors and differ in their adjustments to changing social expectations. Abilities summarised as 'computer literacy', 'skill at virtual reality games', 'social sensitivity' or even 'political correctness' might replace IQ testing in future - just as IQ tests themselves once replaced knowledge of Latin, Greek and English grammar as publicly usable criteria of people's employability. If a society encourages the performance of certain rituals - whether demonstration of familiarity with the works of Jacques Derrida, or the scrupulous avoidance of wearing ties - supposedly intelligent people will presumably be over-represented among the first to grasp what are the latest local requirements for ease of passage and socio-economic success.

Some of the above questions will doubtless be answered one day; and this book is intended provide some pointers - though the very latest apparent yardsticks of intelligence will always invite controversy. Meanwhile, however, there are four main questions about intelligence that do seem to border on being answerable in the present. It is these more manageable, yet still contested questions that are the concern of this book - just as they have been the concern of psychologists throughout the twentieth century.

1. Are there general intellectual differences between people which affect most mental abilities and which can be reliably and fairly 'measured' by current psychometric techniques?

2. If individual differences in 'general intelligence'(*g*) can be identified and assessed, what is known of g's essential nature - of the underlying psychological mechanisms and processes that yield the conspicuous differences in test-scores and everyday abilities?

3. How do such measured *g* differences arise developmentally between people - from genetic and/or environmental sources and their psychogenetic interplay?

4. Must *g* differences be considered to be of psychotelic importance to people's individual personalities, attainments, life chances and responsiveness to educational provision - perhaps suggesting some biosocial purpose, function or survival-value?

The four chapters of the book deal in turn with these four questions. Such questions - about psychometrics, psychology, psychogenetics and psychotelics - are the four classic questions of differential psychology: they can be asked in principle about any proposed 'dimension' of personality, ability, motivation or belief.

More limited as these four questions might seem than questions about other species and other times, they have nevertheless remained controversial both in psychology and in the biosocial sciences as a whole despite excellent selections of material for general and more sophisticated audiences - e.g. in the specialist works of Hans Eysenck (1979), Arthur Jensen (1980, 1981), Nat Brody (1992) and Charles Locurto (1991), and in the contributions to public debate by Herrnstein & Murray (1994), Itzkoff (1994), Rushton (1995) and Wooldridge (1994). Perhaps because there really are four broad

questions that are all controversial, arguments about human differences in intelligence often take an unhelpful, question-hopping form. Discussions of IQ's degree of heritability can veer off into questions about whether there is 'any such one thing' as intelligence; and discussion of the fairness of tests can end in proclamations that what mental tests measure is anyhow unimportant. Herrnstein & Murray's The Bell Curve (1994) is an example of sustained and engaging presentation of new material about one of the questions about IQ - the fourth, psychotelic question; but it (quite deliberately) offered less coverage of the other three traditional questions. To that extent it did not help readers exercised by the full range of disputes about IQ and found itself criticized for ignoring other types of intelligence, for not saying what intelligence really was, and for vagueness about the role of heredity: instead of addressing the book's main psychotelic propositions, critics hopped to other questions that the authors had expressly set aside. The present book therefore tries to introduce all of the four questions and some of the main evidence relevant to each of them. While this approach risks superficiality, especially in a short introduction to intelligence, it is hoped to provide signposting to, and exemplifying detail of the main modern answers to all four questions. No bolt-hole will be left unflagged.

This book also makes a second assumption. It is not just that all four main questions about intelligence that need to be addressed within the same covers. The full range of arguments about intelligence is not always admitted by psychological writers. It can be attractive to concentrate on factual essentials and to encourage belief in a professional consensus among 'experts' - the works of Snyderman & Rothman (1989) and Seligman (1992/3) have this appeal. Yet drawing a veil over dissension with modern psychology may actually lose the confidence of readers. It probably needs to be

admitted frankly that many educational, occupational, cognitive and developmental psychologists have remained edgy with, or sullenly hostile to the *g* factor - for all that few of them have at their command the daring or the scholarship of a Leon Kamin (1974, 1995). The lines of reply to them thus need to be sketched - though readers requiring detail will have to consult longer volumes. Thus the present short book tries to indicate the full range of issues that are at stake and the main lines of traditional and modern argument within psychology about each of them. In particular, relatively full coverage is given in turn to the specially controversial questions of:

1. whether tests of the *g* type are fair to minorities;

2. whether fundamental understanding of intelligence needs to be in terms of 'multiple components', 'cognitive strategies' and 'complex developmental interactions';

3. whether accepting the existence of heritable *g* differences is to set out in the direction of 'fascism' or compulsory eugenics; and

4. whether accepting the educational relevance of *g* would necessarily lead to a reimposition of educational streaming, segregation or any still wider apartheid.

The hope is that there is an advantage in facing up to these questions more directly than is usual in introductions to intelligence: research may thus be easier to consider dispassionately than when it is feared that its findings have implications that are both unadmitted unacceptable.

No-one can work seriously in the field of intelligence today without becoming involved in the controversies that arise as science begins to

illuminate human nature and to challenge aspects of conservative, egalitarian, liberal or utopian ideologies. The problems are the more delicate in so far as today's familiar packages of social attitudes have themselves replaced packages of the past that were frankly tyrannical in tendency and grievously ill-informed. However, controversy yields comradeship too. So it is a pleasant duty for me to thank in particular friends, colleagues and students without whose help, encouragement and greatly valued criticism this book could hardly have been written: Dr Gail Addis, Professor Michael Anderson (University of Western Australia), Professor Tom Bouchard, Trish Connolly, Professor Ian Deary, Dr Vincent Egan, Professor Ray Fancher, Professor Peter Hacker, Professor Arthur Jensen, Dr Geoffrey Madell, Professor Nick Martin, George McMeekin, Zuleika von Meck, Magie Mieze, John Pate, Deirdre Quinn, Andrew Sadler, Dr Boris Semeonoff , Mary Stewart, Dr Con Stough, John Wakelin and Kate Ward. All who are familiar with these scholars and supporters of scholarship will know that they are emphatically not responsible for the book's mistakes.

CHRIS BRAND
EDINBURGH - January 1996

Introduction

- *From Aristotle & Aquinas to empiricism & idealism*
- *Empiricism & idealism: attractions and problems.*
- *The business of the book: can intelligence be 'real'?*
- *Vox populi....*
- *Definitions of intelligence?*

Many hopeful concepts in modern psychology have met lasting customer resistance: infantile sexuality, the death wish, one-trial learning, subliminal perception, self-actualization and authoritarianism-of-the-left have all made quite as many enemies as friends. Intelligence is similar - or worse. It has been at once crucial to psychology, interesting to the public and controversial to experts. Elitism, racism, ignorance and 'ignoracism' are among the accusations that have been hurled at each other by protagonists of the different views that will be registered in this book.

To some, the study of intelligence might seem a simple success story. Friends of IQ would claim that intelligence was the first human characteristic that psychology could measure; that it proved

possible to trace some of the causes of differences in intelligence to genes and brain functions; that, despite much research into other personality factors by occupational psychologists, intelligence remained the only widely useful predictor of career success; and that mainstream academic psychology has lately come to focus chiefly on intelligence - although re-naming it 'cognition'. On the other hand, however, there is protest. Despite IQ tests being in wide use since 1910, many working psychologists would be loath to concede that such tests tap the most important, general way in which people differ psychologically. Many psychologists can be relied upon to deny that there is any such (one) 'thing' as intelligence. Intelligence has been thought a 'label' that is both scientifically and politically unhelpful; harmful effects of racial and other prejudices on a growing child's intelligence are thought to have been played down by IQ enthusiasts out of a dogmatic belief in heredity; and modern 'cognitive psychology', it may be explained, has really been trying (since its invention, around 1970) to break intelligence and cognition down into numerous separate components - thus making IQ-testing a thing of the past (if ever the analytic cognitive breakdown were completed). Still worse, though some of these divisions may be bridged by psychologists' factual inquiries, others are philosophical.

The concept of intelligence first appears in the writings of Aristotle (384-322 BC). Not content with the stress of Plato (428-348 BC) on the supremacy of theoretical reasoning (i.e. of formal, logical or mathematical reasoning) in his account of the mind, Aristotle made room equally for practical reasoning: for him, reasoning included how people worked out the best education, the best husband, and the best route to Thessalonika. For Aristotle, thinking was concerned as much with the achievement of everyday objectives as it was with the acquisition of abstract knowledge. Whereas

active, analytical understanding arrived at abstractions, insights and restructuring of knowledge (e.g. changes in the categories and grouping principles used), passive understanding involved the intake and synthesis of the offerings of the senses and the imagination. To use the terms of the twentieth-century psychologist, Jean Piaget (1896-1980), Aristotelian intelligence involved not only 'accommodatory' re-arrangements of learning and adjustive re-structuring, but also the 'assimilatory' processes of intake that inform them. In the language of today's cognitive psychology, intelligence involved not only high-level, overarching strategies, heuristics (formulae) and 'meta-processes' (principles about processes) but also information-gathering from the environment and very 'basic' processes of transmission of simple information. Though Aristotle's Logic (showing the correct forms of syllogistic reasoning) was eventually to be one of his best-known legacies to the Christian world, his unusually broad conception of human understanding was to be another. Translated into Latin by Cicero (106-43 BC), what Aristotle called 'understanding' became intelligentia; and, once details of Aristotle's system of thought were brought back into mediaeval western Europe by Muslim invaders and by Rome's conquest of Constantinople, the genius of Aquinas (1225-1274) made intelligence a key concept of mediaeval Western psychology. Man had an intelligence that was deemed competent to deliver truth - even in matters of theology.

Aristotle's scientific ideas could not expect to go unchallenged. After all, his data base was so slight that he had concluded (from the corrugations of the cerebral cortex) that the brain was chiefly a radiator for cooling the blood. (By the twentieth century A.D. it proved possible to modify this notion - though Aristotle may still have been right about the most remote evolutionary origins of the brain in control of body temperature (Falk, 1990). Even the

more central mentalistic concepts of Aristotle and Aquinas eventually faced two escalating challenges that would not go away. On the one hand, the rising tide of (British) empiricism (and its descendant, positivism) queried the use by scientists and scholars of all propositions (other than those of sheer logic) that could not be supported by the provision of the hard, physical and objective evidence that had to come ultimately from the senses. On the other hand, the philosophical counter-surge of (mainly German) idealism, insisted that there were no realities of any kind except the constructions of human consciousness and language. To talk of the existence of intelligence (or of intelligence differences between people) was unacceptable to both of these main philosophical schools whose wide influence on other disciplines was to reach through to the end of the twentieth century. The tendency was for Anglo-Saxon intellectuals to scorn the abstract and the German intellectuals to scorn the concrete possibilities of knowledge. They were all unhappy with mental as distinct from material realities and with the efficacy of human rational agency; and both schools maintained, in their different ways, that humanity was a creation of society. (Empiricists claimed experience was all; and idealists claimed that language was all. - But society was the chief source of both experience and language.)

Empiricism's chief offshoot in Anglo-Saxon psychology, behaviourism, presumed that all such abstractions as 'intelligence' (and likewise 'the will', 'consciousness', and 'emotion') would need to be broken down into sets of statements having tangible reference to particular, observable 'behaviours' and performances of testees. Such unpackaging would allow them to be scrutinized. If a fully satisfying decomposition could not after all be accomplished, these terms would be revealed as relics of Christian (or Greek) mysticism and fancifulness and as unsuitable for use in science - hence the preference

for dropping most of them. With even 'consciousness' overboard, behaviourists were certainly not inclined to suppose that, just because two intelligence tests correlated with each other, they would therefore measure the same single quality of mind - let alone 'thing'.

On the other hand, idealism and its chief psychological offshoot of constructivism held all mental concepts to be inventions of the human mind. Not content with denying the fundamental force of human reason, idealists would go beyond the empiricists in denying even that any of our ideas might be adequately traced to bases in veridical perception. However seemingly 'scientific', mental concepts were just like others to the idealist. Chihuahas, cyclones, concubinage and conscience - all concepts come into being only among language users. Concepts would thus reflect the influence of culture and politics: in particular, their deployment would express the hegemony, interests and value-judgments of particular social groupings. Constructivists (in this like behaviourists) had no interest in studies examining the possible heritability of human differences in intelligence - no matter how straightforward or 'powerful' the available methods. The physicist and philosopher-of-science, Thomas Kuhn (1962), and kindred sociologists of science had characterized science and its concepts as being, at least at its "pre-mature" outset, partly the invention of scientists as they simply felt a preference for one paradigm rather than another.*(1)* Happily following this largely relativistic lead, constructivists assumed that all 'mental qualities' - and not just those eliminated by the empiricists - would one day be revealed as little but expressions of the Zeitgeist. While behaviourists rejected the concept of 'intelligence' because it was too mental and subjective, idealists would reject it because, in involving quantification and objectivity, it was not subjective enough.

Followers of both these main schools of twentieth-century philosophy thus agreed in abjuring Aristotelian realism (with its dualistic acknowledgment of both mind and matter). According to the popular derivatives of both empiricism and idealism, it was unhelpful to think that there is any real world of mentality - of mental phenomena, feelings and faculties - to which scientists try to make their theories correspond. Already in 1896, the British theoretical psychologist, G.F.Stout (1896, Vol. 1, p.18) had set the tone for the twentieth century by declaring "such words as potentiality, faculty [and] susceptibility" to be "mere marks of our ignorance." Whether, between them, blunt empiricism and unanchored idealism could avoid the challenge of a true science of the mind would remain the big question for psychology in the twentieth-century.

Distinctive social changes can be traced to the twentieth-century pressures on realism by empiricists and idealists. The modern worlds of business, governmental bureaucracy and the universities are ostensible converts to the behaviourist idea that every task can be broken down into elements that allow it to be taught piecemeal to just about anyone, regardless of personal characteristics (including intelligence). Employees today are commonly 'assessed' - at least when assessment is public - in terms of how they perform in very particular situations (file management skills, summarizing the week's achievements, contributing to discussion, etc.) that can be objectively specified. Indeed, the performances that are officially required will at least look as if employees could prepare for them by rote learning and rehearsal. Such apparently fair-minded practices of situation-specific assessment follow naturally from acceptance of behaviourist approaches. For example, behaviourists suggest

handling problems like phobias, impotence and school failure by 'controlled behavioural desensitization' (i.e. gentle exposure) - or equally by 'flooding' (i.e. violent exposure); and they claim to be able to teach by rote or by 'modelling' (imitation) the particular skills apparently required by clients (e.g. 'social skills' for use in queues, domestic arguments or interviews). The Zeitgeist makes it churlish to challenge the rhetoric that, without bothering with the underpinning features of personality envisaged by realists, behaviour and ideas can readily be changed. Utopianism is a comfort: no-one is lastingly superior and everyone can be retrained in new skills or - as idealists would prefer - 'discourse'. Idealism additionally contributes to the modern world via its relativistic acceptance that one set of ideas is as good as another - since there is nothing to which ideas have to be made to correspond: this encourages a tolerance of other people's ideas which has helped to create the modern world of international trade, travel and political co-operation.

So attractive were the doctrines of empiricism and idealism to psychology through the twentieth century that it was possible to draw a veil for a while over their problems. Behaviourists could 'extinguish' specific phobias by repeated exposure so long as the sufferer did not have wider neurotic problems; and, just as any idealist could wish, most sentences that people use in speech are novel (and readily altered - e.g. into the negative). Thus it was possible for psychologists to forget the countless features of human behaviour, personality, psychopathology, thought content and language-use that could not be thus altered. However, empiricism and idealism were to experience grave set-backs. Notably, they proved unconvincing in what became the twentieth century's core quest in philosophy. The problem was to provide, if possible, a plausible account of the century's intellectual and practical success story, science - to provide an adequate

'philosophy of science', as the quest came to be called. Empiricism insists that truths (other than those of logic) require tangible confirmation in direct experience and observation; so it has difficulty countenancing scientists' use of unobservable hypothetical entities such as electrons and gravity - not to mention quarks and black holes. Even the reality of the existence of life itself remains problematic to empiricists while this biochemical phenomenon cannot be specified in terms of measurable phenomena of chemistry. The empiricist (qua 'nominalist') is a mistruster of mere names; and, as the philosopher, J.S.Mill (1806-1873), observed, of the human tendency to imagine that any as-yet-undiscovered entities must be "peculiarly abstruse and mysterious." On the other hand, idealism maintains that virtually all 'truths' - whether scientific, moral or theological - have nothing but the same relativistic status: all are merely aspects of consciousness, culture and language and can change quickly once fashion gives the word. Thus idealism and empiricism both have difficulty with scientific progress. Today much is known about the structures of the universe, the brain, human ethnic groups and cultures and other species than was known a century ago. Yet both empiricism and idealism view science as just a set of 'rules' for moving from one description to another. The empiricist allows that rules are based on discovered regularities, while the idealist holds them to be a social convenience (at least for the language-making classes); but, when predicting from X to Z, both are unhappy to allow Y to come in between - let alone the rich, deep structure of the universe from which alone a scientist will typically make predictions.

Perhaps most spectacularly, popular empiricism and idealism were both challenged by the arrival, from 1960, of psychopharmacological amelioriation (via chlorpromazine, lithium and beta-blockers) for serious psychiatric disorders (schizophrenia, manic-

depressive illnesses and chronic anxiety). Again, there was increasing research evidence (from twin and adoption studies) that psychotic illnesses ran rather noticeably along genetic lines and had many associated neurological complications. Contrary to popular theories of the role of lack of love, lack of stimulation or inconsistent parenting, serious psychopathology could not in fact be traced to such environmental causes operating either alone or in specifiable conjunction with patients' personalities.

A spectacular case was that of childhood autism (the Rain Man syndrome): at first blamed on bookish, 'refrigerator mothers', this condition gradually turned out to involve exposure physical ailments (like German measles) and unusual constellations of genetic factors (i.e. epistasis - see Chapter III): the children's early symptoms were not caused by but merely noticed sooner by middle class parents. The conversion of Britain's top child psychiatrist, Sir Michael Rutter, from environmentalism about this sad and still very mysterious condition marked the turning of the tide (Burne, 1994).

For empiricists, the surprise was that complicated disorders that defied simple behavioural description were in fact quite 'real' enough to be significantly triggered by physical problems and controlled by drugs - even though the routes by which psychiatric medications took their effects were far from being understood. The 'rule' was that chlorpromazine allowed sufferers from schizophrenia to live outside hospital; but the gap between medication and outcome was not one that the empiricist could hope to fill. For idealists, it was just as surprising that profound disorders of thinking (or 'labels', supposedly reflecting the culture-serving biases of psychiatric experts, as envisaged by Laing (1964) or Foucault (1970)) could be so well controlled (or indeed rescinded, by the very same experts) as to half-empty the mental hospitals of the West. This

advance by drug companies, together with increasing evidence of genetic involvement in schizophrenia, was a breakthrough for realism and to this day upsets the liberal and utopian consciousness that would frankly prefer human beings to have proved more changeable by means that were more 'social' than those actually disclosed to mainstream medicine and scholarship. (Indeed, drug use of all kinds - including recreational use - testifies to the reality of many of the complex mental states that should strictly be dismissed as 'fanciful' by systematic empiricists, and as 'rhetoric' by serious idealists.) Still, despite the successes of realists, the remaining (and growing) social problems of crime, drug addiction, child abuse, unemployment and ethnic strife continue to encourage behaviourists and constructivists to believe that their own favoured approaches might one day prove as relevant as realism to the improvement of the human condition. Especially if the reality and importance of intelligence differences can be denied, there is plenty of hope for empiricism and idealism.

Intelligence itself might at any time have slipped decisively into or out of the purview of realism. It could at any stage have turned out to be affected by some crucial protein, mineral or vitamin; or twin research might have broken it up into quite distinct components - some genetic, perhaps, and others determined by environment. However, systematic experimentation on human intelligence was ethically impossible; there was no lucky breakthrough to drug control (as there had been for schizophrenia); and twin studies were rare since few thought it necessary to check and quantify the importance of environmental factors. So the issue of whether intelligence was a 'real', important variable of general significance had to be addressed in other ways. Matters were further complicated by political and educational arguments in which the notion of intelligence was easily embroiled; and by

some of the peculiarities of IQ researchers (and, as Chapter III will discuss, of equally determined non-researchers).

The business of this book is thus to tell an unconcluded tale that is important to psychology, to philosophy, and probably to politics. The concern is to introduce IQ and the controversies that properly surround it - especially those that bear on whether intelligence can be at last established or finally eradicated as a central concept in describing human nature. Today, the case for realism in psychology and social science probably stands or falls by IQ. If IQ differences are not real then there can be little else in psychology that is: even an academic defence of 'sex' as more than a social creation would be hard going if IQ had been shunted off as an elitist fiction.

That intelligence is real enough to be at least a metaphorical 'possession' seems widely allowed. Despite a century of protest by empiricists and idealists, the concept that descended from Aristotle via Aquinas is still a part of present-day vocabulary. The following quotations may serve to illustrate such everyday usage - supplemented as this might be by references to people's 'intellect', 'sense', 'creativity', 'understanding' and just 'ability'.

'INTELLIGENCE' IN MODERN USAGE

"Gerard Depardieu plays Danton; he is a bovine and sometimes slack-jawed actor who looks here as if he has spent the night crawling through a cornfield. But his physical presence tends to conceal the intelligence which he invests in each part, and so he is perfectly suited to play a character whose animal cunning is only matched by his sensual greed."
Peter ACKROYD, 1983, The Spectator, 24 ix.

*

"A human disposal chute for uppers, downers, hash, grass, LSD, cocaine, heroin and common-or-garden booze, [Keith Richards, of the 'Rolling Stones'] has not been kind to his system. Yet somehow he has survived a ten-year heroin odyssey and is now 'clean'. This reflects a certain constitutional toughness, but also an intelligence and good sense he is not often credited with."
ANON., 1985, The Spectator, 18 v.

*

"In public, Princess Michael [of Kent] is a dazzling figure. In private, she is warm, funny, frank and possessed of high intelligence and formidable energy. Her force of character has been given added edge by [her unpropitious beginnings - born as the monarchies of Eastern Europe were collapsing]."
Anne De COURCY, 1985, Sunday Telegraph, 6 i

*

"Like pearls from oysters, [a great chef's dishes] result from lonely struggling effort, and also from intelligence and quite exceptional intuition."
Egon RONAY, 1988; quoted in Private Eye, 1 iv.

*

"She has energy, intelligence, articulation, the best voice in the world, the best body, the best face, and the best appreciation of a joke."
Warren BEATTY, speaking of his newlywed wife, Annette Bening, to Vanity Fair; quoted in The Independent on Sunday (Sunday Review), 24 v 1992.

*

"Given my wish to seduce Chloe, it was essential that I find out more about her. How could I abandon my true self

unless I knew what false self to adopt? But this was no easy task, a reminder that understanding another requires hours of careful attention and interpretation, teasing a coherent character from a thousand words and actions. Unfortunately, the patience and intelligence required went far beyond the capacities of my anxious, infatuated mind."
Alain DE BOTTON, 1993, Essays in Love. London : Macmillan.

*

"Joan Littlewood is the greatest theatre director of the present century, knocking possible rivals....into a cocked hat when it comes to intelligence, originality and the incalculable influence for good she has had on theatre all over the world.... "

John WELLS, 1994, The Spectator, 2 iv.

*

"MANCUNIAN MAN, 33, handsome, intelligent, warm, witty, emotionally open seeks tall, sensual blue-stocking for lively committed relationship."
Private Eye, 10 ii 1995.

*

"Intelligence, without which beauty was just beauty, leavened everything Garbo did."
Barry PARIS, 1995, Garbo: a Biography. London : Sidgwick & Jackson.

Today we are still living in the long shadow of Aristotelian realism. Yet is Aristotle's a kindly or a gloomy shade? Should we be reminding ourselves of our luck; or be trying to escape from over-simplification to sunlit uplands of relativism where man and his conventions are acknowledged the

measure of all things? This is the large question that lies behind the four particular questions to be addressed directly in the four chapters of book: these concern the psychometric measurement, the psychological bases, the psychogenetic origins and the psychotelic importance of intelligence.

On encountering such questions it is tempting to begin to address them by adopting some 'definition'. How, after all, can scientists measure intelligence if 'no-one knows what it really is'? Thus a search for scholarly and at least half-adequate definitions begins. Attempted definitions of intelligence might include such classics as 'reasoning ability', 'learning ability', 'the eduction of relations and correlates', 'general cognitive resources' or even - risking leaving the realm of psychology altogether - 'the application of information to situation' or 'organism-environment correspondence' (the idea favoured by Herbert Spencer (1820-1903) when he re-introduced the term in his Principles of Psychology (1855)). (For many further attempts, see Baker, 1974, pp. 495-6.) However, the problem is that any definition that manages to be more engaging than what can be found in a dictionary turns out to be unacceptable to someone or other. For example, intelligence cannot be 'the ability to learn' since much conditioning (whether by association of stimuli or by reward and punishment) does not require intelligence. To define intelligence in terms of school learning would be far too narrow; and, anyhow, in researches, many intelligent children improve less than others over a school year of teaching (mainly because they know more of the curriculum at the year's outset).

Thus Chapter 1 begins not with a definition of intelligence but with the failure of late-nineteenth-century British and German laboratory psychologists to come up with a test looking as if it measured intelligence by any criterion at all; and with the crucial work in this field by a French

psychologist who was previously best known for his work on hypnosis and sexual fetishism. This work was to provide what seemed to other psychologists the first plausible measurement of intelligence. Yet, like other scientific concepts (such as electricity, gravity and heat), intelligence would long prove easier to 'measure' than to understand; and easier to understand than to discuss without animosity. Disputes would persist - suggesting at least that psychology had found itself a topic that was central to a proper understanding of human nature and political society.

ENDNOTES

1. Kuhn's own position is sometimes distinguished from that of his sociological followers along the following lines (Hull, 1996).
   "....within science studies, those who view science as relative to time and place have adopted Kuhn as one of their patron saints. Because the transition [of scientists] from one paradigm to another cannot be explained entirely in terms of reasons, argument and evidence, such factors play no role whatever in such transitions. ....Kuhn himself was dismayed by his relativist disciples. This was not what he intended at all!"

I - UNITY IN DIVERSITY

I : Unity in Diversity

- *The quest for scientific psychology circa 1900; Watson, behaviourism and anti-mentalism.*
- *From Binet to Wechsler and Cattell: the early history of mental testing.*
- *Why do mental tests and test-items inter-correlate?*
- *Six ways of avoiding talk of general intelligence (g).*
- *Jensen's six defences of the validity and fairness of tests of g.*
- *There must be more than g?*
- *Five special, non-g -related, differential ability dimensions (viz. the 'Big Five').*

OUTLINE

Is it reasonable to impressed by someone who knows the dates of the battles of Flodden, Leipzig and Stalingrad? This person may just have specialized in history, or seen a TV programme about 'great battles that changed the world'. If not, the best guess might still be that the person merely has an unusually good memory for figures. To be sure of sampling a person's general knowledge requires care, a lot of items and only those errors of measurement that happily cancel each other out.

This chapter outlines the discovery of easily-administered questions, correct answers to which by children and adults are indeed widely predictive. The intellectual background and the early achievements of the 'founding fathers' of IQ-testing are indicated; the case for talking of a general factor among mental abilities is critically discussed; and five more specialized (yet still very broad) differences between people in abilities and strategies are suggested as supplements to the general factor.

Do relations between widely varying test items require and license talk of a unitary dimension of 'general intelligence' (*g*)? (*g* is the usual symbol for those psychological differences that are apparently reflected in tests of Mental Age and IQ.) Why do people who do well at one mental test tend also to do well at many others? The existence of real individual differences along a *g* dimension provides one hypothesis; and, if the mental tests that have the highest and widest links are any guide, the *g* factor would seem especially involved in the detection of meaning and of the regular patterns made by symbols (i.e. words, numbers and shapes). However, other ways of explaining relations between mental measures may seem just as likely. Influences of educational, motivational, socio-economic, racial and 'labelling' differences are particularly examined. Perhaps it is merely these external, local and artificial differences that bring about the positive relations that are found in the general population between many mental tests? Perhaps the

unfair advantages enjoyed by some testees can do all the explanatory work without there being any further reality to the hypothetical *g* factor?

Whatever the linkages that give rise to talk of IQ and *g* , there are other ability variations that occur independently - even if they account for much less of the overall variation between people in mental abilities. Using modern personality theory to supplement today's data, five dimensions of contrast are suggested in personal strategies of information-handling and problem-solving.

The beginning of the twentieth century was a momentous period for psychology. In Britain, Germany and the USA, there was talk of a 'new', 'scientific' psychology. The laboratory of Wilhelm Wundt (1832-1920) in Leipzig had been operational for twenty years. A version of Wundt's stress on experimentation had spread to the United States: there, Edward Titchener (1867-1927) and students practised introspective reporting of consciously experienced sensations under precise conditions. Yet at the same time there were many strains. In Vienna, Franz Brentano (1838-1917) and his School stressed the unique character of thought and action as always being about something: unlike tables and chairs, which are not 'about' anything at all, thoughts and actions are inherently 'intensional' and do not just exist in mere quantity or quality. (Though sensations and reflexes might be adequately described in such terms, not to know what is the object of a thought or the purpose of an action is to miss something that is essential.) Also in Vienna, Sigmund Freud (1856-1939) was coming to emphasize the importance of unconscious mental life. If Brentano and Freud were right, even the most rigorous introspection in the laboratory would miss the real business of the human mind - and of the human heart and soul. So whose would be the 'new' psychology?

In the University of Chicago, John Broadus Watson (1878-1958) was about to become the youngest-ever PhD graduate of his University's combined department of psychology and philosophy. Watson would reject the uncertainties of studying experiences, thoughts or mental entities of any kind, and set psychology to study and account for behaviour. The spirited son of an alcoholic South Carolina father (though named John Broadus by his mother after a Baptist preacher of that name), Watson had grown up in the outback and was used to animals and their training. Having a juvenile arrest-record and a secret first marriage (to frustrate the opposition of his girlfriend's brother), the experimental psychology of his day seemed dull. It required Chicago students to sit quietly reporting the subjective duration and intensity of tone signals and light-patches. Watson was to write: "I hated to serve as a subject. I didn't like the stuffy, artificial instructions given to subjects. I was always uncomfortable and acted unnaturally." Unsurprisingly, Watson's subsequent research for his PhD involved the more objective material of physiological psychology. (His thesis examined the growth of myelin sheaths around the nerves of young animals: as it takes place, myelination makes for developmental advances in perception and motor skills - and perhaps much else.) Yet Watson was not pointing psychology towards physiology just for a glimpse of its own underpinnings: rather, he would go on to claim that psychology need be literally nothing but physiology. Watson supposed that thoughts, emotions and the rest of experience and behaviour would soon be revealed as nothing more than reflex arcs. Once appointed to Johns Hopkins University, Watson resolved to take psychology by the horns. In 1914, his first book, Behavior: an Introduction to Comparative Psychology outlined his radical plan for psychology which would lead to experiments on behaviour - though mainly on the behaviour of animals.

Despite much academic criticism - and even astonishment - Watson's behaviourist proposals would long guide the study and state-funded practice of psychology. Watson's idea was that human thinking, feeling and motivation, and all abstract mental entities such as intelligence and personality traits might be conveniently 'reduced to' (or understood in terms of) chains and

constellations of observable reflexes and 'habits'. Tirelessly anticipating such discoveries and thus the prospect of behavioural control, Watson's followers would maintain in principle that anyone could be trained ('conditioned') to do anything whatsoever. In particular, behaviourists would decline to believe people could be 'retarded', by any vague impediments in 'intelligence' or other faculties. Such undiscriminating and unhelpful accounts of human handicaps would be best left to philosophers and lay people, and abjured by the true science of psychology. As Watson (1924) put it *(1)*:

> "There are inheritable differences in *structure*, but we no longer believe in inherited *capacities, talent, temperament, mental constitution* and *characteristics*. Give me a dozen healthy infants, and my own world to bring them up in, and I'll guarantee to train any one of them to become any type of specialist I might select - doctor, lawyer, artist, merchant chief, and even beggar-man or thief."

Once he was driven out of academic life (by his brother-in-law reporting him for an affair with his star student, Rosalie Rayner) Watson (once married to Rosalie) would write a popular baby-book that counselled fashionably against the 'spoiling' of children before turning his skills to the marketing of cigarettes and toothpaste. Though himself no steady devotee of the study of the rat, his enthusiasm for conditioning proved infectious - especially in departments of psychology in American universities by 1940, and later in Britain. In experimental psychology, behaviourism would long provide the main academic challenge to the existence of human faculties - and to the reality of intelligence.

While Watson hatched behaviourism in Chicago, in Paris the career of the fifty-year-old Alfred Binet (1857-1911), Director of Physiological Psychology at the Sorbonne, and writer of popular melodramas, was reaching its culmination. Whereas Watson had grown restive at the slow progress of psychologists and philosophers with the complexities of human consciousness and mentality, Binet's discontent was with the medical profession and its tendency to dogmatism. Binet's father, himself a doctor, had once frightened his five-year-old son by showing him a corpse; and the sensitive Binet eventually dropped out of medical school to study a human science that could in those days be studied in libraries - psychology. Later, Binet's career in psychology - involving work on hysteria and hypnosis - had brought him into contact with startling psychiatric symptomatology and with the imposing medical and neurological personages of his day. Taking the physicians seriously as they demonstrated 'hysterical dissociation' by switching patients' paralyses from one arm to another, Binet underestimated for a while the sheer conformity and obedience of the patients in the great doctors' hospitals. Sharp and public academic criticism of his own gullibility was the painful result (Fancher, 1985)*(2)*. Later, once a young doctor, Théodore Simon (1873-1961) had arranged his first access to the mentally retarded, Binet had discovered that the medical 'diagnoses' of idiocy, imbecility and cretinism in children were also less authoritative than they sounded: two different doctors could easily fail to agree a categorization, and children's diagnoses might be changed alarmingly from one certificate of mental deficiency to another, "as if they had been drawn by chance out of a sack" (Binet & Simon, 1905). Thus Binet, though no slouch at physiological psychology, arrived at an ambition distinct from Watson's, yet one that would have a similar type of appeal for twentieth-century psychologists. Just as Watson hoped to liberate psychology from philosophy, introspection and all mentalism, so Binet hoped to liberate it from the presumptions of medicine.

In fact, the doctors of Binet's day were doing their best to assist with the problems that had arisen for all European schools from nation states making school attendance compulsory. Before North American success at growing wheat led to the collapse of European agricultural prices and

to a surge in urbanization (Stone, 1988?), children could simply be left in illiteracy with their peasant parents - for they would still prove employable and marriageable in the countryside. However, this relaxed attitude could not continue after 1870 as agriculture declined and urban squalor increased; so legal compulsion forced handicapped, retarded, hyperactive and unwilling children alike into schools that did not see themselves as providing mere playgrounds or child-minding services. Soon teachers sought legal ways of dealing with those children they judged ineducable by normal methods. Especially, they appealed to the fast-rising authority of medicine*(3)*.

Yet there was something strange about what teachers were doing. Why, asked Binet, should a child's need for special or slower-paced schooling be judged only 'pedagogically' (by the child's school results) or medically (by physical signs, symptoms, stigmata, and the skull readings of the phrenologists)? After all, school failure could have causes of various, quite different kinds. Some children might do poorly at school because of lack of home encouragement or because of a poor relationship with a teacher - common enough in days when the use of physical punishment was widespread; and plenty of children with physical and neurological problems are actually educable in a largely normal way given a little patience, suitable remedial opportunities and firm suppression of bullying. At most some, not all school failure need be attributed to lack of ability; and Binet (1900) had shown that "cephalic measures" were unreliable and made rather little distinction even between schoolchildren judged to be at the extremes of ability. Thus, in 1904, Binet found himself commissioned by the French minister of public education to answer the question that he himself had posed: how to measure a child's capacity for learning - to common sense, its intelligence - by a direct psychological method, rather than indirectly via attainments or neurological problems.

How should Binet begin? In London, the Victorian gentleman-scientist, Sir Francis Galton (1822-1911) (the half-cousin of Charles Darwin, co-founder of the journal *Nature*, discoverer of the anticyclone, inventor of the modern weather map, explorer of what is now Namibia and eventual founder of the Eugenics Laboratory*(4)* in London University) had tried. He had hoped that quickness of reaction time and acuity of sensory discrimination might relate to teachers' estimates of children's intelligence. As a result of his passion for numbers (a top British psychiatrist once called it an obsession), Galton (1886) had come up with a calculus for quantifying degree of 'correlation' (i.e. strength of association) between variables. Soon developed by his student and colleague, Karl Pearson (1857-1936), the statistic *r* involved multiplying individuals' deviations on any two variables from their group's mean scores on them. An individual with high deviations from average on both variables would thus contribute highly to *r* ; by contrast, an individual with average scores on both variables would contibute nothing. The *r* statistic thus expressed the strength of association between two variables on a scale from +1.00 (perfect positive correlation), through zero (no correlation), to -1.00 (perfect negative correlation)*(5)*.

The *r* correlation coefficient provides a measure of *strength* of the relation between two variables: this allows psychology to go beyond merely talking about *significant* relations which often arise just because a large number of subjects has been studied or because (e.g. with animals) a big experimental manipulation has been contrived. Concern with *significance* rather than with *strength* of relation was to prove all too congenial to the many twentieth century psychologists who themselves found no strong effects to study - except by gross and technical laboratory manipulations of no relevance to questions about human personality. Such psychologists preferred to draw a veil over the issue and to complain that natural correlations between variables 'did not reveal causation'. However, quantitative assessment of strength of relationship is integral to any science that has moved beyond the nursery; and it was not the followers of Galton who would unfailingly interpret correlations between X-at-Time-1 (say,

parental handling of child) and Y-at-Time-2 (say, *adolescent delinquency*) as showing causation by X - rather than looking for wider social or biological, 'Z' factors that might have been causing variations in both X and Y (see Meehl, 1990 and Cohen, 1994.)

Just as futuristically, Galton had set up a laboratory (in South Kensington) to record anthropometric data, reaction times and high-frequency auditory sensitivity in members of the general public - who paid for the privilege. However, though professional people had somewhat faster reaction times than unskilled workers (see Johnson *et al.* , 1985), Galton had used no problem-solving measures and found no promise in his three measures of sensory and motor ability - indeed, he seems not to have troubled to analyze his copious data. There were discouraging problems of unreliability and of only moderate similarities between siblings - despite siblings sharing family environment and fifty per cent of those genetic variations that occur at all commonly between people. More seriously, Galton's middle-class adult volunteers - enthusiasts for science as they were - did not vary especially widely: they would have shown only rather low correlations amongst their scores even if Galton's procedures had actually been effective in tapping intelligence differences. In contrast with Galton, Hermann Ebbinghaus (1850-1909), working in Wϋrzburg and Breslau, had actually begun to use promising tests of 'closure' (whether the testee could fill a gap made by the tester in a simple word or sentence); but, since Ebbinghaus was not studying the big developmental differences of childhood and lacked Galton's technique of calculating the strength of correlation between variables, he did not realize that he had an early measure of intelligence in his hands.

Fortunately for his own assignment, Binet did not stick to searching for any single or 'theoretically basic' measure of intelligence. Neither was he pre-occupied with any one definition of intelligence. From his study of his two growing daughters - one a budding young scientist, the other more artistically inclined - Binet was impressed that good intelligence could easily take different forms. Instead of locking intelligence prematurely to 'understanding', 'judgement', 'reasoning', 'learning', 'memory', 'speed', 'perception', 'concentration' or 'imagination', Binet realized that there was only one general point about human intelligence on which there was wide agreement. Whatever it might be said to be and however it might be measured, intelligence is usually thought to increase through childhood (at least until mid-adolescence) without that increase requiring any unusual sensory acuity or any special education or training. Binet's otherwise comprehensive search was guided by these two simple constraints. (For detail of Binet's ten-year programme, see Matarazzo, 1992.)

Binet began to question children to see whether they could name simple colours, unwrap and eat a sweet, pick out the longer of two lines (3cm., 4cm.), remember shopping lists, arrange weights in order (3, 6, 9, 12 and 15 grams), make rough copies of a line-drawn square, diamond and cylinder (see Figure 1), or construct sentences containing given words (e.g. 'Paris', 'fortune' and 'river').

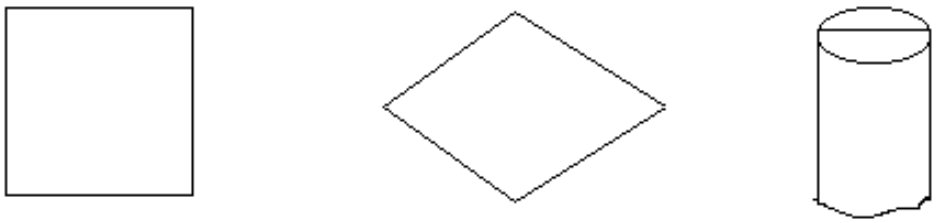


Figure I.1 : In the Figure Copying Test, a child is shown one simple figure on each trial and then asked to draw it from memory. (The child can be shown the figure again - though copying will then start afresh. Detailed accuracy and neatness of the child's copy are unimportant.). The square can be copied by the average white 5-year-old child, the diamond by age 8, and the cylinder by age 10. Jensen (1980, pp.662-665) finds that this ability correlates very highly with many others in childhood. The problem is not perceptual or manual - since an 8-year-old who fails at copying the diamond will have been quite able to copy the square; as Jensen says, "it is the child's analytic concept of the figure that governs performance." The ability itself cannot be trained: 5-year-olds who are trained (with some difficulty) to copy the cylinder will show no gains when asked to copy the diamond or other intermediate items (e.g.triangle) on which they have not been specifically trained.

Binet quite often asked children to re-discover meaning: he would ask them to re-assemble sentences, paragraphs and pictures that had been violated or scrambled into their component parts (thus extending the principle of 'closure' tests). Yet comprehensiveness was Binet's keynote: a wide range of 'tests' was tried - including requests that children shake hands or copy the strange adult tester in putting their fingers into comical positions on their noses and ears. Avoidance of tasks resembling schoolwork was strict: "It is the intelligence alone that we seek to measure, by disregarding in so far as possible the degree of instruction which the child possesses.... We give him nothing to read, nothing to write, and submit him to no test in which he might succeed by means of rote learning" (Binet & Simon, 1905). Some items were harder than others and were typically passed only by older children; and children who passed one such hard item were more likely than other children to pass other items of a similar degree of difficulty. At age five, for example, the average child could say which of two objects was heavier, copy a square, and count four coins. Thus, even without the *r* statistic, Binet came to:

1. talk of the *level* of a child's performance across the entire range of items;
2. summarize that level by saying that a particular child performed like the average child of a certain *chronological age* (CA); and
3. attribute that CA as a *mental age* (MA) to the child.

Expressing MA in relation to the child's own CA as suggested by the eminent German psychologist and personality theorist, William Stern (1871-1938), the Intelligence Quotient (IQ) was born:

$$IQ = (MA / CA) \times 100.$$

Binet himself always wanted to provide more than such a single number by which to express a child's intelligence, and so did Stern; but they were to have no more luck than did Galton with his own daydreams. In the absence of further findings of equivalent interest about mental abilities, and in view of the clear rationale for MA in the regularities of children's performance, the IQ number caught on. Mental abilities correlate as strongly as human height and weight are correlated: just as people vary generally in overall physical size and development, so they vary in general intelligence. There are many intriguing complications - just as good athletes are usually better at some events than at others. Yet when the whole population is considered, generality of ability is the more striking phenomenon - just as athletes who excel at one or two events will be well above the population average of ability at virtually any event. Eventually, in the 1930's, the American psychometrician-psychologist, David Wechsler (1896-1981) would try out similar individually administered tests for adults. By this time, the correlation coefficient was a commonplace; so Wechsler supplied correlations between his tests on a standardized sample of adults of all ages, all socio-economic groups and both sexes. The tests included general factual

knowledge, everyday comprehension (e.g. of how to post a letter), memory for short strings of numbers, picture completion, jig-saw puzzles, and re-arranging scrambled, wordless cartoon frames into the right order. Wechsler found that his ten-minute tests showed striking correlations, of around +.65, from one occasion of testing to another; and they correlated strongly with each other, at around +.50 - a much stronger relation than is found between variables investigated in most psychological and social-scientific researches. As had happened for Binet, all reliable mental tests, however different their content, apparently had something in common. To allow for the fact that MA does not increase after age 15 in line with CA, Wechsler's Adult Intelligence Scale (WAIS) calculated an adult's IQ by comparison with the levels achieved by age peers. A mean of 100 and a standard deviation of 15 were retained so that 98% of IQ's fall in the range 55 -145, as do 98% of the IQ's of children when Stern's original (MA/CA)100 equation is used.*(6)* [By contrast, the tests of Cattell (see below) which came to be used by MENSA, the society for high-IQ people, use a fixed standard deviation of 24 points. Cattell observed that, if adult CA was set at 15 (so that IQ's do not decline with advancing chronological age), the true standard deviation of (MA/CA)100 scores in the full population, *including representatives of all age groups*, was actually 24 IQ points. This greater range of IQ's occurs because of the particularly low MA's obtained by young children and by some older adults (see Chapter II). An IQ of 130 using the Wechsler-type standard deviation for calculating IQ is thus equivalent to a Cattell-type IQ of 148 - both scores indicating that the testee falls just within the top 2· 5% of age-peers.]

Especially when put in multiple-choice form for administration to whole groups of testees, IQ tests found a ready market in the heterogeneous USA. Here, true mental differences between people would often have been overshadowed by the big cultural and linguistic differences between immigrants; so IQ tests could reasonably be expected to prove fairer than were school records to the basic abilities of the country's diverse minorities. At Stanford University, Lewis Terman (1877-1956) adapted and expanded Binet's package of tests*(7)* and campaigned tirelessly for using IQ test results to assist the implementation of public policy. The Harvard psychologist, Robert M.Yerkes (1876-1956), headed a team (including Terman and Henry H. Goddard (1866-1957)) which pioneered 'group' testing to assist military selection procedures and thereby collected the first large-scale data on mental abilities beyond childhood. The 'Army Alpha' test was provided for literate recruits; other testees, together with recruits who did poorly on Alpha, were to take the 'Army Beta.' Beta was primarily a pictorial test including mazes, jigsaws, cube counting and picture completion; it required only comprehension of spoken instructions in English, accompanied by blackboard demonstrations; and, though numbers had to be recognized, no arithmetical ability was required.) Any remaining uncertainties were supposed to be resolved by Binet-type individual testing: this would be necessary when a testee had failed even the simplest items, perhaps because of some difficulty in following the instructions.

Over 1917-18, 1,75 million U.S. Army draftees and others participated in the programme - though sometimes in overcrowded conditions supervised by army staff lacking training in and understanding of the exercise. Notable findings were the high IQ's of conscientious objectors (something of a surprise to Colonel Yerkes) and the low IQ's of prostitutes ("from 30 to 60 per cent of prostitutes are deficient and for the most part high- *g* rade morons" [i.e. below MA 12, or IQ 80] (Yerkes, 1921)). Alpha scores correlated highly, at .75, with education; but cause and effect remained to be decided. Though this correlation strongly suggested that education conferred advantages under the testing conditions mentioned, it was, in principle, still compatible with the non-environmental theory "that native intelligence is one of the most important conditioning factors in continuance in school...." (Yerkes *et al.* , 1921). Interestingly, immigrants who had come from different ethnic backgrounds had MA's that differed more than could be explained by their differences in familiarity with English:

- Immigrants from Canada and the British Isles had MA 13.8;

- Immigrants from Germany, Holland and Scandinavia had MA 13.0;
- Immigrants from Mediterranean countries had MA 11.4.

Additionally, the more recent immigrants had the lower MA's - which a young colleague of Yerkes blamed on the rising proportions of immigrants from southern and eastern Europe (Brigham, 1923). Thus Terman's ambition was fulfilled as the earliest large-scale evidence about IQ was advanced in the course of the great debates that culminated, in 1924, in the USA's restricting further immigration to the proportions from different countries that had originally obtained in the U.S. population in 1890. IQ had arrived in politics - for all that most countries would long continue to admit migrants chiefly by the more elementary principles of how much money migrants were prepared to spend and whether voters liked the look of them.*(8)*

The likely relevance of IQ test evidence to more immediate, practical problems was equally appreciated. Foreshadowing what would be a long-running use of the tests to assist the judiciary, the court testimony of Terman in 1918 as to the low IQ of a seventeen-year-old Hispanic, Alberto Flores, procured the latter's exemption from the death penalty for sexual assault and murder. By the 1920's the tests were occasionally used by Goddard on New York's Ellis Island to furnish 'clinical' evidence as to which of Europe's refugees from famine, nationalism, communism and civil war could be expected to cope in the free-enterprise, English-speaking and qualification-conscious USA*(9)*. The enthusiasm for measuring intelligence affected even Britain - a country renowned for its complacency about theories and experts of any kind. By 1923 the tests had been used in the selection of 30,000 British civil servants (mainly for clerical posts) (Spearman, 1923, p.2); and, by 1940, tests involving 'matrices' (see Figure I,2) were in use by the British Army in the selection of officers, spies and high- *g* rade technical personnel. As Wilson (1993) has outlined, in societies locked into racial, ethnic, class, sexual, and 'old-school-tie' discrimination, IQ testing was a liberating and improving force. In situations where choice clearly had to be made, it offered a simple, inexpensive and relatively reliable way of identifying: (a) the ablest potential students, employees and fellow citizens; and (b) the least able who might need special education, guardianship and "the surveillance and protection of society" that Terman urged.

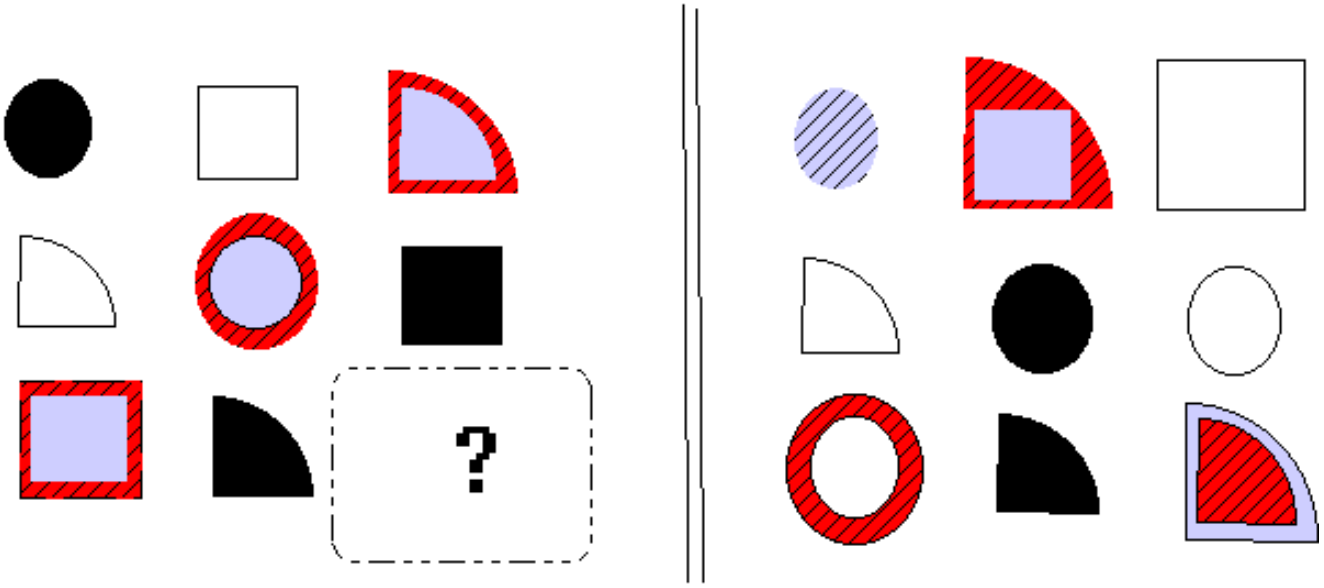


Figure I.2: In 'matrices' items the testee completes the overall pattern made by the figures on the left by selecting for the question box one of the figures on the right (see e.g. Raven, 1989).

Not everyone agreed that what was being tapped by the tests was intelligence. In 1922, America's star newspaper columnist, Walter Lippman, responding to the report of a conference on IQ (Journal of Educational Psychology, 1921), declared it laughable to claim from scores on the tests that the average American Army recruit (while admittedly having greater knowledge, experience and acquired skills) had little more general intelligence than a normal 13-year-old (see Block & Dworkin, 1976); and, indeed, Harvard's Edwin Boring (1886-1968) (one of the most distinguished psychologists of his day, who himself possessed a prodigious intellect and had gone to university at age 12) had obliged would-be critics by joking to the conference that 'all we know about *intelligence* is that it is what the tests test'. Such would long remain the principal objections to the tests from critics who doubted their value and feared their misuse; and there is no doubt that the early use of tests had raced ahead without the checks that would be required today. The low 13.1-year MA of 'the average recruit' in the US Army data was indeed something of an artefact. There had been far too many zero scores on some subtests - suggesting that some testees had simply not understood instructions. The recruits had been compared to a non-Army sample that over-represented high school pupils and educated adults; and the Army had allowed illiterate recruits to attempt Alpha and then often not found the time to test them with Beta. However, there was correct and understandable excitement at the now massive empirical evidence that intelligence did not generally increase beyond age 15 and at the tests' relevance to officer selection.

Eventually, following in the footsteps of Wechsler and a somewhat chastened Brigham (1930), the Staffordshire-born Raymond Cattell (*b.* 1905, taking up psychology and objective measurement along with socialism in response to the horrors of World War I, and working as the Leicester Area School Psychologist before emigrating to the U.S.A.) would conclude that it was best to recognize two partly distinguishable types of test for general intelligence (*g*) - resembling the abilities required for success at Beta and Alpha. Some mental tests require mental work on the spot with largely unfamiliar materials and problems (e.g. to find what is missing from a drawing - perhaps one of a dog's ears*(10)* - or to solve simple jig-saw puzzles from their pieces alone). Others require stored knowledge (e.g. of the meanings of words and proverbs, or of simple mental arithmetical operations) which, for the time being, the testee either possesses or lacks. Cattell called these types of intelligence 'fluid' (gf) and 'crystallized' (gc) respectively. Cattell particularly confirmed suggestions arising from Wechsler's work that, although half-hour tests of g_f and g_c correlated very strongly, at around .70, in normal ranges of children and young adults, the g_f and g_c scores of one person in eight diverge significantly. For example, children who were much below-average in exposure to normal schooling (e.g. Britain's canal boat children and American children of poor-white, rural families) showed the pattern g_f > gc; on the other hand, in late-middle-aged and elderly people, g_c would often 'hold' well while g_f declined.

Still, for Binet, Wechsler and Cattell to have identified a plausible age curve for g_f,*(11)* to have shown how g_c sometimes diverges from gf, and to have provided a wide range of types of test indexing both expressions of general intelligence was soon to seem but a slight achievement. In the generation after 1945, it would become unfashionable to regard intelligence and IQ levels as enduring and consequential characteristics of individuals.*(12)* As Binet himself might have wondered: could two substantially correlated IQ's - g_f and g_c (or Performance and Verbal, as Wechsler called them) - be much of an advance on just one? Might not the correlations between mental tests be explained without referring to any hypothetical general intelligence at all? Might not mental tests be found that would simply not correlate so highly? Could there perhaps have been some way in which, whatever the improving ambitions and objectivity of the early testers, truths about human intelligence that were at once more complex and more intrinsically 'social' had slipped through their fingers? Perhaps Lippman and Boring had articulated the very reservations that had actually made Binet cautious about his psychometric breakthrough and led his colleague, Thomas Simon, to denounce the use of global, general IQ scores as "treachery"?

According to a leading modern critic of the *g* factor, the distinguished Harvard biologist, Stephen J. Gould (1981/1982, p.315), "The fact of pervasive intercorrelation between mental tests must be among the most unsurprising major discoveries in the history of science." Thus Gould professes no more surprise at test intercorrelation than would an opposing theorist who was prepared to talk of 'real' individual differences in general intelligence. Yet a normal expectation is that time spent in one activity is time that is lost for another: an evening spent doing crossword puzzles or metaphysics is an evening lost to practising jigsaws or swatting up metallurgy. Thus, in so far as 'practice makes perfect' and time is finite, the pervasive intercorrelation between mental abilities should actually tend to be negative; and a prediction of negative correlation should particularly made by anyone who, like Gould, is inclined to treat measured IQ-type abilities as collections of attainments. Why, then, do mental tests inter-correlate positively? And how is it that Gould is unsurprised? Could IQ-type tests (and their diverse subtests) reflect influences quite distinct from the *g* levels whose reality Gould doubts? Perhaps there are there better accounts of the 'positive manifold' of correlations between all tests requiring work with symbols? *(13)* And perhaps such accounts are more connected with 'levels' that are social than with levels of anything attributable to the individual? (The question of whether social factors affect *g* itself is considered in Chapter 3. Here the question is with whether talk of the *g* factor might be avoided altogether.)

Examination of possible answers to this question in modern times has been the concern of a figure rather like Binet - especially in his interests in the arts, his painful learning of the need to challenge conventional professional wisdom, and his sustained scholarly interest in work that might help children who have learning difficulties. As Arthur Jensen (*b*. 1923) grew up in San Diego, his hero was the anti-imperialist Indian leader, Mahatma Gandhi, and his great love was for classical music. However, although he was a reasonable clarinetist who had played for the San Diego symphony orchestra, he was advised that he had little chance of the career as a conductor that he wanted. He turned to social work and clinical psychology and thus achieved a teaching post at Berkeley, his alma mater, in 1958. Over the next ten years, Jensen's interests moved gradually towards intelligence:*(14)* from his early interests in 'projective' personality assessments (using the famous ink-blots) and in memory (the serial position effect whereby the ends of lists recalled better than their middles), he shifted towards trying to develop culture-fair assessment of intelligence and towards assessing the results of the early remedial Head Start programmes (to be considered especially in Chapter 4). In his major book presenting his research and scholarship so far, Jensen (1980) focussed on allegations that IQ tests were 'biased' against minorities (especially against black people): he asked repeatedly whether the covariation between mental tests came about for reasons having less to do with intelligence than with opportunities - or their absence. There are in fact six main explanatory options which avoid postulating that IQ tests principally reflect intelligence. All of them have enjoyed support as ways of denying real intelligence differences between individuals and - important in multi-ethnic societies - between human groups; but all have attendant problems, as Jensen was to tease out.

1. The existence and nature of any 'test' may chiefly reflect its own inventor's ideas about what to measure and about how to measure it. Such are the suspicions of testers that even an eminent scientist could write to the leading journal, *Science* (Hubbard, 1972): "The IQ tests ignore much in us that is artistic, contemplative and nonverbal. They were constructed to predict success in the kinds of schools that have prevailed in Europe and the United States." Even today, best-selling American psychologists such as Robert Sternberg (1984, 1985; Allman, 1994) and Howard Gardner (1983, 1993a,b,d) go out of their way to note that IQ tests were devised for predicting success in school, measure chiefly *academic intelligence* and should not be thought to tap into many equally valuable abilities such as common sense, organisational skill or creativity.

In particular, Gardner criticizes the tests for using 'pencil and paper techniques'.

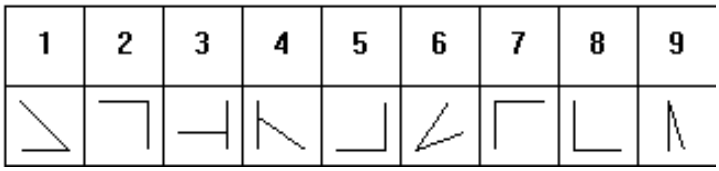
Perhaps the keener schoolchild will necessarily feel happier with such procedures than will the child who suffers school phobia or whose parents spend little time reading or writing? Anyhow, merely being tested by some kind of authority figure may be thought to require a child who is well-drilled and acquiescent rather than 'generally intelligent'. However, to say that IQ tests are 'narrowly academic' reveals an untested assumption more than actual familiarity with the tests themselves.

- (a) Different psychologists from four countries were involved in devising even the earliest mental tests; and today's IQ-type tests are validated, standardized and scrutinized worldwide for the reliability and consistency of the correlations among their items and subtests.

- (b) All the main constructors of IQ tests have thought it folly to try to measure intelligence with only one technique; and most have been persistently curious to discover new and perhaps quite independent types of intelligence (e.g. 'social intelligence', 'empathic understanding', 'perspective taking', 'creativity' and 'moral reasoning'). Thus there has always been a continuous stream of would-be tests becoming available - allowing correlations between supposedly different types of test to be assessed empirically. Sometimes, indeed, testers are criticized for troubling to use everyday social knowledge, as when child testees are asked 'Why is it generally better to give money to an organised charity than to a street beggar?' (According to Evans and Waites (1981, p.131), this item makes the "questionable assumption that organised charities ensure that money goes to those most in need.") However: (i) such an item taps understanding of how to be genuinely charitable - generally speaking, expressly allowing for exceptions; (ii) the correct answer will be especially obvious to any child whose circumstances provide serious familiarity with street beggars; (iii) any spirited child who appears restive with the question's assumption will simply be asked by the tester 'Why is it *said* that...?'; (iv) in any case, such an item, like others, is only used because it does simply turn out in fact to correlate well with many other items.

- (c) For better or worse, IQ-test constructors have never been remotely entranced by the merits of predicting school attainment. Most of them (like Binet himself) seem to have wanted to see brighter children from all social backgrounds being offered a chance to be 'stretched' by a suitably exacting school experience (even if some children's own scholastic attainments were previously poor and their parents entertained few academic aspirations of them); and to see duller children given special help that might compensate for, if not actually eradicate their educational handicaps.

- (d) Very few of the traditional tests used in measuring IQ are in fact of the pencil-and-paper type. For example, only one of Wechsler's eleven subtests of the Wechsler Adult Intelligence Scale (WAIS) involves the testee using pencil and paper; and even this subtest involves copying simple and novel symbols for which no drawing skill is required (see Figure I,3). Tests for use with groups admittedly use pencil and paper: but their results correlate very highly (at around .80) with results from individual testing.



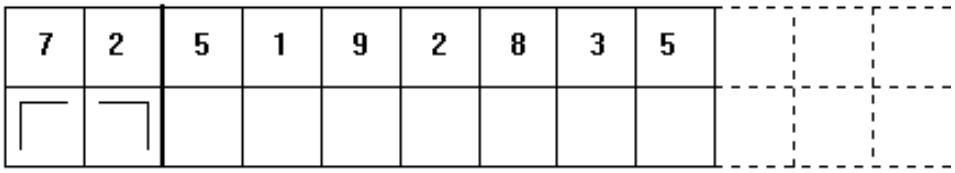


Figure I.3: In Digit Symbol, the testee is first shown the code (at the top): this shows which symbol is to go with which number. Then, with the code always available for inspection, the testee completes as many of the empty boxes as possible within 1,5 minutes. Although of limited reliability (test-retest r = .50) because of its brevity, this test still correlates at around .35 with mental tests that require no use of pencil or paper.

- (e) Across three-quarters of a century, none of IQ's critics has been able to provide any competing test of that 'non-IQ-type' intelligence to which allusion is so readily made in semi-erudite conversation. Although 'mere academic intelligence' is casually scorned, no-one has any validated test of 'non-academic' intelligence that can even be examined by potential enthusiasts. Hopes of such tests have often been entertained - of the 'British Ability Scales', of the Illinois Psycholinguistic Ability Test, of the Kaufman Ability Battery, of some of Jean Piaget's methods (see Chapter II) and of many others; but the putatively 'new' measures of non-IQ-type intelligence invariably turn out to correlate highly with the Binet and Wechsler scales and thus to measure little that was not included in IQ-type tests and in *g* . For example, in the 1970's some psychologists hoped that the measures of intelligence favoured by Piaget and his followers - e.g. measures of 'conservation' (realizing that water does not increase in volume when it is poured into a taller and thinner container - i.e. that its volume is 'conserved' across a superficial transformation) - might yield 'a new IQ'. However, it soon turned out that Piagetian measures correlated as highly as their own reliabilities allowed with conventional measures of *g* , and especially with gf. The only problem-solving tests that have achieved a fleeting 'independence' of IQ are those that are simply unreliable - usually because they have only recently been thought up and have not been checked out for suitability with a wide range of testees in everyday circumstances. (Many of the tests produced as part of J.P.Guilford's great quest to identify and measure no less than 150 hypothetically unrelated mental abilities were sadly of this type.) In the past decade, Sternberg (e.g. 1988) has advocated a 'triarchic' view of 'cognitive behavior' that breaks it into three aspects - performance, monitoring and skill-acquisition; but no more than any other theorist has he shown any degree of actual empirical independence for the individual differences belonging to his three categories.
- (f) Despite years of search for other predictors, *g* still provides the only way of predicting success in most occupations. Even such critics of IQ as Evans & Waites (1981, p.140) allow that lawyers, engineers and chemists virtually never have IQ's below 100. The capacity of *g* to predict success extends even into areas like the military where modern educators may like to jest that 'academic aptitude' is not highly regarded. Much has been hoped by occupational psychologists of 'differential abilities' (see below) and questionnaire self-assessments of personality, but little has been delivered by comparison with what *g* manages to predict. By definition, it cannot be 'narrow academic skills' that boost efficiency ratings and remuneration across a wide range of job types: grasping capitalist employers and crime-busting police chiefs will surely not be taken in for long by mere scholasticism. Rather, something of wider relevance - like the hypothesized *g* factor - would seem to make for higher levels of real-world attainment as much as for success at mental tests. Today, for American adolescents, IQ correlates almost as highly with nonacademic knowledge (r = .78) as with academic knowledge (r = .82) (Humphreys, 1994): the idea that *g* is only 'academic intelligence' is make-believe.

2. Even if *g* is not some narrow, scholastic ability, will not mood and motivation influence testees'

scores? Perhaps high scores can be achieved by those who merely 'try harder' for whatever reason (including even personal vanity or shameless conformism)? Likewise, might not low scores on a range of tests result from feeling poorly, or depressed by domestic circumstances; or from anxiety about mankind's worldwide problems; or from having been upset by an insensitive teacher or personnel manager on the day of the test? If so, would not motivational differences be sufficient to explain the positive manifold?

The answer to such worries is certainly 'yes'. IQ scores do indeed vary a little from one occasion of testing to another: testees can increase their IQ-test scores by some seven points if they practise for a few hours and receive feedback on the particular type of IQ test at which they wish to 'succeed'; those children who are especially inhibited and unresponsive will 'warm up' and put on perhaps 8-10 IQ points if play sessions are provided (Jensen, 1969, p.100); and the reliability of even a 'full scale' 1,5-hour IQ test over a six months' gap is not an ideal +1.00. However, in normal circumstances the reliability of Binet and Wechsler IQ's is still around .93: such reliability is far higher than is found for any other important individual, non-biographical measurement across the entire range of twentieth-century psychology and indeed social science. Recently, a large study in New Zealand has shown children's Wechsler IQ's correlate at .80 from age 9 to age 13 - over which range modern educators typically assume there is much change and inter-individual variability due to different children having different experiences and differently timed 'growth spurts' (Moffitt *et al.* , 1993). The researchers particularly observed that "the reliable change that does take place appears to be very idiosyncratic: it is not systematically associated with environmental changes." In Canada, across the adult age-range 20 to 60, a long-term follow-up of normal Second World War conscripts first tested in 1944 found test-retest correlation of .78 (Schwartzman *et al.* , 1987). Such reliability should not be too surprising: attempts to influence IQ-test performance by offering cash prizes have been unsuccessful; IQ-test performance is not systematically affected by testees being made more or less anxious about the significance of the test*(15)* - for some testees work a little better under pressure; and individual levels of self-reported worry and depression show little relation with IQ. IQ correlates weakly and negatively, at around -.15, with self-reported anxiety. Since anxiety actually correlates at a similar level but *positively*, around +.15, with academic attainments in higher education, there is no reason to think that anxiety lowers intelligence. It is equally likely that lower intelligence itself creates minor life stresses for people or that it directly makes people feel anxious and less able to cope. As for IQ tests being fakeable, so are Snellen eye tests and thermometer readings: it is only within sensible parameters that tests will measure what they are supposed to measure. IQ results have been observed to be "remarkably robust" across minor illness, fatigue, ambient temperature and ambient noise (Humphreys, 1994).

3. Perhaps motivational effects are not so much short-term as long-term? Perhaps some testees generally have more long-term motivation to succeed at the tests of psychologists and educators? Perhaps the 'high motivation' of some testees may even last a lifetime - enabling them to score more successes at tests and comparable examinations even at age 60? Such ideas are plausible in so far as many measures of 'achievement motivation' constructed by psychologists (e.g. asking whether testees 'enjoy work' and 'prefer competitive to co-operative activities') do indeed show a modest (.30) correlation with IQ. (In fact, many supposed tests of achievement striving do not seem to measure anything very much unless there are intelligence differences between the testees being compared: the correlation between achievement motivation and IQ is quite often as high as the reliability of the achievement tests themselves, thus leaving nothing else for these tests to measure (Fineman, 1977).) Yet higher-IQ people do not in fact perform well at all those tricks and puzzles that psychologists can dream up. Measures of 'simple reaction time' (e.g. speed of pressing a button, as instructed, when a single light comes on) and of 'rote memory' (e.g. for nonsense syllables like VAW, TOQ and DEH) show only a slight advantage for subjects of higher IQ (see Jensen,1987 and Lynn & Wilson,1990). Why should the hypothesized 'higher motivation' of higher-IQ testees fail them on tasks where no use of symbols is involved or when overnight retention of meaningless material is

examined? Although success in exams and in life is often attributed to 'hard work', no psychologist has ever produced confirmation of this popular causal story - let alone of hard work actually raising intelligence or IQ-test scores.*(16)* Even if there were any demonstrable correlation between hard work and IQ, higher intelligence may just have led its possessors to work hard because their efforts are more successful and earn them larger rewards.)

4. Perhaps scholasticism, motivations and work habits provide little purchase on why some testees perform better than others on most mental tests. Perhaps it would be easier to admit that real, intellectual differences are involved on the tests while claiming that these *g* differences themselves reflect long-term advantages (and disadvantages) that different children experience in view of the 'social classes' into which they are born.*(17)* This claim accepts the validity of the tests as reflectors of *g* ; and it expresses a concern with the causation of individual differences in perfectly real levels of *g* (a topic to be pursued in Chapter IV). However, there may be a distinct appeal to 'social class' that continues to dispute the very existence of *g* . People's differences may be claimed to arise because of the tests' class-related invalidity. According to this hypothesis, failures of items and subtests to tap intelligence make the tests unsuitable for use with testees from particular social groups - at least if the intention is to measure *g* . This 'invalidity' crticism is not that the tests reflect *g* and environmental influences on *g* , but that, at least for some people, they do not measure *g* at all. However, even if this interesting question is examined quite independently of the main nature-nurture question about *g* (for which see Chapter III), four difficulties arise.
    - (a) Whatever may have happened in history, differences in parental social class of origin in the modern West have, quite simply, very modest associations with the educational attainments of children by their early twenties. White (1982) reviewed a hundred studies in the USA and estimated the correlation at around .22; and similar correlations have been reported from Ireland (Greaney & Kellaghan, 1984; Lynn, 1984). Evidently parental SES today scarcely correlates with, so simply cannot be influencing such a crucial variable as educational attainment in young adults. Thus it is quite unclear how it could turn hypothetically unrelated mental test scores into substantial correlates of each other across the social class range.
    - (b) Allowing for restriction of ability range, the same correlations between IQ subtests occur within families as occur for children drawn from different families. The sister who does better on some mental tests will do better than her siblings on others, despite all the children being in a home of the same SES and thus not differing in whether the tests are 'valid for them'.
    - (c) The actual correlation between parental SES and full-scale IQ in adolescence is substantial; but it is still only .40 for what are, after all, the two major variables of Western social science. Even if genetic and environmental influences on *g* itself are altogether discounted, parental class could account for only $.40^2$ = 16% of children's differences in measured ability: at least 84% of IQ variation does not result from class effects of any kind. {See also Box I,1, below.}
    - (d) Although lower-SES children perform worse on g_c than on g_f tests, the correlations amongst the different subtests, and between IQ and external criteria are the same for them as for other children. Even when low-SES children have special handicaps, these do not weaken general correlations or remotely suggest test invalidity. There are certainly some real effects of home environment on child IQ (see Chapter IV); yet that is not because the tests are failing to measure intelligence properly in lower-SES children, but because they are succeeding.

5. There is an important variant on the idea that IQ reflects inappropriately and invalidly the degree of privilege of one's background. It is that some people, notably amongst ethnic minorities and the physically or sensorily handicapped, may find themselves unfairly and incorrectly judged as dull by IQ-type tests. To the extent that this happens, apparent *g* differences across an entire

population will arise if some sub- *g* roups are especially disadvantaged on a wide range of tests - not now by SES alone, or by genuine intellectual limitations, but by detrimental factors specific to minority status. Once more, the combination of groups for whom the tests are invalid with groups for whom they are valid might tend to yield a spurious *g* dimension in the population as a whole. (Of course, the minority groups would have to do badly on the tests despite their hypothetically normal intelligence. To the extent that a critic allows it quite possible to do well on a test that is invalid as a measure of one's intelligence, this argument for a false *g* factor cannot be used.) As with the case of SES (above, (4)), two quite different claims need to be disentangled.

- (a) One is the claim that racial prejudice, sensory handicap and physical incapacity to explore or learn from the environment all actually cause genuinely lower intelligence in victims. This claim does not dispute the validity of IQ tests: indeed, the tests may serve as very useful measures of the degree of harm actually done to the intelligence of victims by their environmental or constitutional problems. For example, deaf children have entirely normal levels of performance on *gf* tests despite having missed much of the supposedly enriching and stimulating world of language and verbal communication; but, especially in childhood, they do have lower scores on *gc* tests requiring knowledge of language (Braden, 1994). In both cases, the tests are valid; but one type, gc, requiring normal verbal skills, registers - quite properly, and indeed quite fairly - a real handicap.*(18)*

- (b) On the other hand, it is sometimes believed that IQ tests are 'invalid' for particular groups, as if the low IQ estimates yielded in some cases were not in fact seriously meaningful - perhaps because black children should be thought to have their very own dialect of English which is especially rich in monosyllables (e.g. Labov, 1973). However, for criticism to succeed would require that mental tests and subtests did not show the same correlations within minority group testees as they do within the rest of the population; and this is far from what actually happens. IQ tests are just as 'good' at measuring, amongst black or Asian minority testees,*(19)* whatever they normally measure elsewhere. A 'Black Intelligence Test for Children' was constructed in the early 1970's (asking about knowledge of what were then distinctive Afro-Caribbean colloquialisms, like 'The Bump' and 'going down on'); and white children duly had the lower scores (Williams, 1972?, Matarazzo & Wiens, 1977; Jensen, 1980, pp. 679-681). Yet this 'intelligence test' turned out not to predict any kind of educational, occupational or sociometric success even amongst black youngsters themselves: it was no more a test of intelligence than is expertise in Cockney or Glaswegian for most British children. Conventional IQ tests are just as reliable, internally valid (i.e. self-consistent as between their different parts or items) and externally predictive for blacks as they are for whites; and black children do not improve their IQ's when tests are translated into black ghetto dialect by linguistics specialists (e.g. Quay, 1974).

Reviewing her study of three thousand children (Grades 3-8) in Philadelphia state schools, two thirds of them black, one third white, Scarr-Salapatek (1971, 1972) found measures of aptitude to predict school achievement equally well in both racial groups. She wrote: "Many would like to claim that the low average IQ scores of disadvantaged children result from measurement invalidity, but I find no support whatsoever in my data for this assertion." For adults in the USA., IQ tests correlate just as well with job performance in all racial groups. (If anything, the tests slightly over-predict scholastic and workplace performance by blacks and are to that extent unfair to whites and Asians in competition for the same positions - see Hartigan & Wigdor, 1989.) Nor is there any general problem of test-taking motivation for minority children: black children do perfectly well at laboratory tests that are not correlated with IQ - such as drawing a straight line, threading beads, or recalling past events (Montie & Fagan, 1988); and deaf children, despite their gross cultural deprivation, have no special problems with non-verbal tests that are well known as good measures of IQ.*(20)* The question of what causes Afro-Caribbeans to have low

IQ-type scores (even as early as age 3 and even when selected as having mothers who are married and have enjoyed a college education) is of great interest (and will be considered in Chapter IV); but it seems the answer will have to involve test validity, not invalidity. Even when particular IQ items are identified by sociologists and educationists as appearing 'culturally unfair' to minorities, investigation shows that black children actually do a little better on these (often requiring memory and learning) than on items selected as 'unbiassed' (and requiring *gf*) (McGurk, 1975 - in a review of 105 published articles). At every age and at every level of family income, black children are no worse on Wechsler Vocabulary than they are at Block Design (Roberts, 1971). Jensen's demonstrations were an important beginning of the answer to the 1979 ruling of a Californian court banning the use of IQ tests by state authorities:*(21)* Judge Peckham's ruling had expressly remarked the lack of evidence from testing personnel about the validity of the tests in use with black children and adults themselves, but such evidence was soon available in quantity. Overall, the slight degree to which IQ test variance is attributable to either social class or racial differences in the US population is shown in the **Box I,1:**

Do IQ tests discriminate mostly along the lines of race and social class? Do IQ differences chiefly reflect children's differences in social advantage vs disadvantage - i.e. in the class (socio-economic status (SES)) or race (black, white) of their parents?

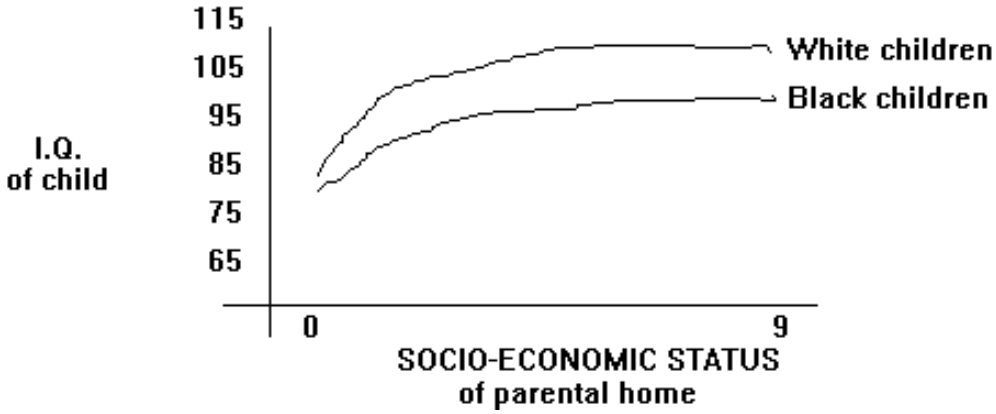
Arthur Jensen (1980, pp. 42-3, 57-9) examined the Wechsler IQ's of 622 black and 622 white children from 98 Californian schools. Both groups involved children of 5-12 years old who were representative of their racial groups in SES levels. [These data had been collected by Dr Jane Mercer; the Wechsler Intelligence Scale for Children (Revised) (Wechsler, 1974) was used; and SES was calculated as by O.D.Duncan (e.g. 1968) from parental occupations.] The correlations between the three variables, IQ, race and SES, were all around .45; so the partial correlations amongst any two of these variables, controlling for the remaining variable, were around .30. For comparative variance between siblings, between average families and between random individuals, Jensen used his own Lorge-Thorndike IQ data and WISC-R standardization data. The following Table shows: (1) the percentage of variance in IQ attributable to each source; and (2) the average IQ difference attributable to each source.

Table 1.

Source of variance	(1) % IQ variance	(2) Average IQ difference
Between races, independently of SES	14	12 pts (between black and white)
Between SES groups, independently of race	8	6 pts (between High and Low)
Between families, within race & SES groups	29	9 pts (between random families)
Within families (thus within same race & SES)	44	12 pts (between siblings)
Measurement error (using one-month reliability)	5	4 pts (between self 1 and self2)
TOTAL	100	17 pts (between two random individuals)

Jensen explains: "The reason that race and SES account for relatively little (i.e. 22 per cent) of the total variance of IQ....is that there is so much variability *within* racial and SES groups relative to the difference between the means....Average differences among groups may seem overwhelming until they are viewed in [conjunction with] the total variation in the population."

The following Figure illustrates the race and class differences. It may be seen how these group differences account for little of the population range in individual IQ scores.



6. A last doubt about IQ-test validity is that 'measured' differences may be little but the products of other people's expectations, 'labels' and self-fulfilling prophecies. Once more, there are two versions of such a claim.

    - (a) One is that differences in expectations (e.g. by children's teachers) may have real effects on intelligence. This is a claim for which no evidence has ever been offered other than from IQ-type testing; and, if IQ-test evidence is considered relevant, the claimant is accepting IQ-test validity.

    - (b) The other version is that expectancies may particularly affect only IQ scores. Such invalid scores may eventually become reality via subsequent differential provision of educational opportunities. The idea is that differential treatment, in response to initial IQ scores, may yield real, 'self-fulfilling prophecy' effects on intelligence itself. Fortunately, though it is now well recognized that one-off perceptual judgments and children's achievements in swimming, athletics and laboratory learning can sometimes reflect initially erroneous expectancies (of teachers, parents or pupils), hundreds of studies in the past twenty-five years*(22)* have found little general effect of such 'labelling' effects on IQ. In the most systematic study in a normal school setting (Kellaghan *et al*, 1982), expectancies of teachers supplied with IQ information about pupils did not generally change children's IQ's or attainments over a school year. (There was a slight boost to the end-of-the-year achievements of those (genuinely) higher-IQ children who came from relatively low-SES families: the teachers may have been trying to discount background SES and to 'bring on' such children towards the attainment levels normally expected from children of such IQ's.) Far from labelling or self-labelling themselves giving rise to IQ-type differences and so to spurious correlations and a *g* dimension among mental tests, it is noticeable that many genuinely bright people have a misleadingly modest impression of their own abilities - often claiming on TV shows to be 'poor spellers', for example; while vanity amongst

people of mediocre intelligence is probably easier to find (see Brand *et al.* , 1994).

Thus all the six proposed escape routes from admitting that IQ tests measure intelligence turn out to be blind alleys. As much as household thermometers or kitchen scales, IQ tests are generally reliable and make distinctions that are not interpretable as discriminatory. None of the above six arguments has concerned what is the nature of intelligence, how intelligence differences arise, or whether intelligence is of any importance. (These three matters are the respective concerns of the next three chapters.) However, it transpires that, in trying to explain why mental tests correlate and why the same testees who do well on one type of test also do well on others, the proposition that there are real and general mental differences between people is very hard to avoid. These differences have no ready interpretation other than that they must consist in something approximating 'general intelligence.' Testers' whims, testees' moods and motivational idiosyncrasies, the social classes of testees' parents, minority group statuses and 'labelling' effects are quite unable explain the correlations between tests or to account for more than tiny proportions of population variation in IQ except in so far as it is admitted precisely that estimates of IQ do indeed reflect people's relatively enduring levels of general intelligence. A report published by the National Institute of Education in the USA once complained of "the myth of measurability" and insisted that "a person's abilities, activities and attitudes cannot be measured" (Tyler & White, 1979, p.376). For general mental ability, at least, there is no such "myth". Complaining about the validity and fairness of IQ-type tests has been a popular way of avoiding serious consideration of the other questions about IQ differences - about their unity, essence, origins and function; but the complaints do not withstand scrutiny. In empirical testimony, two massive research programmes on the use of IQ tests in occupational selection in the USA have shown the tests to be equally useful (i.e. valid and predictive) with all racial groups. Reynolds & Brown (1984) brought together the main strands of the voluminous evidence on whether and when IQ tests were unfair to minorities. Blinkhorn (1985) provides a review and observes that "....the problem is not that tests under-predict the performance of blacks [in industry] but that they over-predict it."

IQ has undoubtedly been more fully checked for possible bias than has any other variable in psychology (Barrett & Depinet, 1991; Humphreys, 1992). More recently, Schmidt *et al.* (1992) find no evidence of test unfairness in the largest-ever psychometric investigation of all time - into the use of testing by the U.S. Army (Project Alpha). Again, if bias is simply assumed to have resulted from racist prejudices of the early testers, then why do the tests not reflect Victorian sexism by yielding a sizeable difference betwen the sexes? Finally, if IQ tests are still somehow to be called 'unfair', the critic should say what is fairer. Is it fairer to decline to recognize people's differences - and thus to treat unlike cases alike, i.e. with injustice? Is it better to disbelieve in differences - as if one could somehow rig one's own beliefs in such matters when so many tests correlate? Or can the critic actually indicate a measure of intelligence that is 'fairer'? Quite conspicuously, despite 75 years of opportunity, no alternative to IQ testing has appeared - though those independent, non-*g* mental ability differences that do emerge from such searches must now be considered.*(23)*

As Binet asserted, people do not differ only in their level of general intelligence. They also differ in more particular ways, for example in musical, numerical, map-reading and empathic abilities. How extensive is such specificity on tasks requiring mental work? How much do people vary in ways that are reliably measurable yet not attributable to their *g* differences alone? What proportion of people's tested differences reflects *g* differences,

and what proportions reflect independent specifics? After sixty years of hunting for non-*g* mental ability specifics, there exists no standard package of tests for them nor any conspicuous agreement on their number. The lack of g-free ability tests occurs partly because the everyday demand of employers is for the specific ability together with the advantage that higher *g* will also convey:*(24)* in practice, an employer seeking high levels of, say, the spatio-mechanical aptitude that makes people good with gadgets will happily use a test which, though it uses problems involving levers and pulleys, is also correlated about .50 with *g* . Perhaps more surprisingly, there is only modest agreement between theoreticians as to what are the main specifics that can be isolated even once the *g* factor is set aside:*(25)* theoreticians have been more interested in what has proved the thankless task of breaking up *g* itself so as to seize substantial chunks of its variance to increase the size of their own preferred 'specifics'. Once *g* is set aside (or 'partialled out') in representative samples, specifics like verbal, spatial and associational (memory) abilities can usually be found if relevant tests have been used; but they each account for only about a sixth of the ability variation between people that is attributable to *g* (e.g. Blaha & Wallbrown, 1982; Jensen, 1985; Carroll, 1993). Probably the search for non-*g* dimensions needs to be extended to include strategy differences: such bipolar differences occur in so far as choices need to be made between partly incompatible goals such as speed vs accuracy or concentration vs breadth-of-attention. An obvious starting point in any consideration of such contrasting strategies is with the 'Big Five-or-Six' dimensions of human personality difference in self-report data that have lately attracted psychometrician-psychologists (e.g. Brand, 1984a; Deary & Matthews, 1993; Brand, 1994a; Ormerod *et al.* , 1995). Taking a very broad overview of historical and current research into human differences in both abilities and self-reported preferences,*(26)* some five specific ability contrasts might be suggested to be largely unrelated to *g* (as in Brand, 1994b) - though, astonishingly,*(27)* researchers have yet to adopt Cattell's practice of collecting both questionnaire and ability data from the same subjects. Like *g* itself, these five dimensions can probably be seen in both 'fluid' and 'crystallized' forms - if measures of temperament and attitudes are expressly used (see Brand, 1994b).

1. The longest-running distinction between mental abilities dates back to Wechsler's work in the 1930's and the similar discovery by Britain's National Institute for Industrial Psychology that verbal tests were less helpful than performance tests in selection for skilled apprenticeships (Evans & Waites, 1981, p.78). However, the personality distinction between tough- and tender-mindedness can be found in Shakespeare (in King Lear) and William James (1842-1910) (e.g. 1976); and tender-mindedness of personality was first identified systematically in questionnaire data by Cattell (as a mixture of premsia (sensitivity), affectothymia (interest in people) and good manners (Cattell's N) (Cattell, 1973; Cattell & Kline, 1977). Today a broad contrast might be made along all of the following lines - although the verbal / spatial distinction is the best known and most commonly tested by measurement of the different abilities.

VERBAL	vs	SPATIAL, 'PERFORMANCE', CONCRETE
MUSICAL, AUDITORY	vs	MECHANICAL, VISUAL
THEORETICAL, ABSTRACT	vs	PRACTICAL, CONCRETE
INTUITIVE, IMAGINATIVE	vs	PERCEPTUAL, SENSORY

INTEREST IN PEOPLE vs INTEREST IN MATERIAL THINGS

Classically the V-P discrepancy was often held to be related to personality and to type of psychopathology - with delinquents, criminals and personality-disordered patients scoring relatively 'low-Verbal' (accounting for the CIA's long-standing interest in V-P differences when testing potential spies and informers). Typically, women are more 'verbal/intuitive' than men; likewise women score higher on the moderately correlated personality measures of tender-mindedness, Openness/Imagination, affection, empathy, trust, idealism and aesthetic and religious values (Minton & Schneider, 1980; Sidanius & Ekehammer, 1982; Gibson, 1979; Vernon, 1982). Apparently this broad dimension of contrast between specifics is one of sensitivity to the higher, less prosaic elements of culture and social experience; and it involves response to symbolic significance and a relatively wide receptivity to experience as opposed to closer reality contact. At the verbal/intuitive end, a broad intake of in-context material is probably achieved by operating abstractly and at a distance from the coarser aspects of reality that sometimes require the relatively direct, quick, perceptually driven and practical responding of the higher-Performance person. The higher-verbal, higher-idealism person is perhaps taking in more by standing back further from the scene, but at the cost of 'miniaturizing' what is viewed and sometimes sacrificing important practical details. In line with the sex difference, the distinction would usually correlate with arts versus science interests. (In everyday life this 'opposition' is usually obscured since higher- *g* people having more interest in both art and science - just as they have more interests of both masculine and feminine 'types' (e.g. Hamilton, 1995).) Such questionnaire dimensions as Openness and tender-mindedness have strong empirical links to the Jungian contrast between perception by intuition and perception by the senses (e.g. McCrae & Costa, 1989). The broad distinction suggested here may seem easy to confuse with the crystallized-fluid distinction (between *gc* and *gf* and - see above): but the latter is linked to age and knowledge rather than to feminine sensibilities and intuition vs practical abilities. The present distinction involves greater preoccupation with the mental and socio-emotional than with the material and tangible aspects of the world.

2. The second dimension also seems related to how information is taken in from the world. Aspects of it would be as follows.

FIELD INDEPENDENCE vs FIELD DEPENDENCE

ANALYSIS vs SYNTHESIS

RATIONALITY vs EMPIRICISM

DEDUCTION vs INDUCTION

First identified by the USAF psychologist, Herman Witkin (1916-1979), in the 1950's, and soon shown by Cattell (e.g. 1973) to be connected with personal qualities of 'independence / assertiveness / self-sufficiency vs subduedness / agreeability / group dependence', this dimension also yields something of a sex difference. Males perform better on tasks requiring narrow attention that sets aside demands of context that are irrelevant to the current task. The classic measure of

this dimension is the Embedded Figures Test (EFT): testees are asked to detect simple figures enmeshed within complex visual designs.*(28)* But, like many tests once intended to tap specific, non-*g* abilities, the EFT correlates at around .45 with *g* ; so a more strictly perceptual test, the Rod-and-Frame Test (RFT) is sometimes used instead. In the RFT, the testee tries to rotate a rod to the true vertical position while the square frame around the rod is itself rotated so as to provide what for many testees are quite powerfully misleading visual cues as to the true vertical. Field independence involves attending narrowly and ignoring currently unwanted influences of context. By contrast, field-dependent people often seem better at taking in and using a wide range of cues of less immediate relevance - as is often helpful in fast-changing, unplanned social situations. Similar dimensional contrasts called 'independence' and 'self-awareness' emerge from other procedures (Kline & Barratt, 1983; Bekker, 1993). Strictly analytic abilities usually seem related to field-independence; in contrast, using social cues pointing to correct answers is more of a speciality of field-dependent people. The ability to ignore distraction is sometimes thought to enable shifts in approaches to tasks and to be subserved by the brain's frontal lobes.*(29)* McCrae & Costa (1989) find their Antagonism vs Agreeableness dimension to link especially to the Jungian contrast between making decisions by reason and making decisions by feeling.

3. Around 1970, a third specific, non-*g* ability distinction had come to light in the work of the 'London School' psychologist and personality theorist, Hans Eysenck, and was developed further in the work of his son, Michael Eysenck.

SHORT-TERM MEMORY	vs	LONG-TERM MEMORY
AROUSAL CONTROL	vs	AROUSAL SUSCEPTIBILITY
BEHAVIOURAL SPEED	vs	POWER (of processing)
BREADTH	vs	DEPTH (of processing)

Hans Eysenck had long presumed quiet and serious 'introverts' to be likely to do relatively well at laboratory tasks requiring vigilance, attention, persistence and memory. In fact, it emerged that, by and large, it was fun-loving 'extraverts' who were better at coming to terms with the novel (and often trivial) tasks of the experimental psychologist's laboratory: they tended to score better in the short term. Introverts did better chiefly if testing was extended over several days and required long term memory storage and recall (see Matthews, 1993; Brand, 1994b). Apparently, extraverts can free attentional resources for rapid performance in the task at hand by the expedient of not engaging in so much long-term storage of what is going on. They can be said to process what is going on less deeply than introverts. The latter analyse input more fully (for meaning, not just for sound or spelling) and link it more widely to what is already stored in memory. It is as if the introvert provides a more 'powerful', memory-establishing treatment of incoming happenings and stimuli; but this extra processing means that the immediately required reaction to the experimenter's problem-stimulus takes longer to arrange. *(30)* As with other mental ability distinctions having little relation to *g* , it must be stressed that both 'extraverted' and 'introverted' strategies (or styles) have their own special advantages; and that higher levels of *g* will improve people's performances at both short-term and long-term memory for meaningful material.

4. By 1980 a fourth dimension required recognition despite early disputes as to its reality. This was a dimension that contrasted loose, fluent, original, bizarre and sometimes 'creative' thinking with a more prosaic, down-to-earth and accuracy-seeking style.

CREATIVITY	vs	CONVENTIONALITY
ORIGINALITY	vs	ACCURACY
LOOSENESS	vs	TIGHTNESS (of associations)
FLUENCY	vs	SUPPRESSION (of associations)

In particular, Hans Eysenck came to agree with an important strand in the suggestions of J.P.Guilford (1897-1987), Liam Hudson and the Glaswegian enfant terrible of British psychiatry, R.D.Laing (1927-1989). This idea was that psychotic (especially, schizophrenic) people might have looser patterns of association to stimuli - perhaps through lacking the normal 'lateral inhibiting mechanisms' that keep most thinking within conventional pathways and allow the elimination of irrelevant responses (cf De La Casa *et al.* , 1993). Called psychoticism by Eysenck (e.g. 1995), the dimension contrasts spontaneity, imagination, impulsivity and a certain indelicacy of expression with a more thorough, scrupulous, or even pedantic and obsessional approach that is highly suited to the once-prized achievement of clerical accuracy. Higher levels of conventionality, conscientiousness and control have sometimes been found in association with what a Freudian would call 'anal' personality features, and also with more traditional, conservative social attitudes (Kline & Barratt, 1983). Once again, in real life, those versions of 'creativity' and 'clerical accuracy' that are actually in any serious demand will usually involve above-average levels of *g* ; so the value-free, bipolar contrast in conscientiousness is really between meticulously careful and cautious versus lax and laid-back approaches. Higher conscientiousness may particularly involve a stronger influence of multifactorial models, patterns and regularities - at the expense of situational flexibility. McCrae & Costa (1989) find this dimension especially linked to another Jungian contrast between problem-solving styles: some people try to arrive at principled judgements (whether, in particular, in accordance with reasons or feelings) and other try to collect more evidence (whether from intuition or the senses).

5. Lastly, beyond *g* , there is a major dimension of learning differences that must be mentioned even though it is not itself much concerned with performance on distinctively mental or symbolic tasks.*(31)*

CONDITIONABILITY	vs	EXTINCTIONABILITY
PUNISHMENT LEARNING	vs	VOLUNTARY UNLEARNING

To many forms of learning (or 'conditioning'), some kind of motivation (by reward, loss of reward, punishment or relief from punishment) seems essential. Such emotional and experiential learning is especially important for anticipating crises,

and it typically seems to involve neural routes in the midbrain that draw little on cortical processing (cf Gray, 1991; Le Doux, 1994; Epstein, 1994). Some people seem to learn especially well under such conditions - perhaps because they bring extra internal 'multipliers' of motivation, drive or emotional arousal to the task. People of a more emotional disposition are more readily moved into extreme mood states (especially into the four main negative mood states of fear, depression, fatigue and hostility) and have been thought to show more susceptibility to motivated learning - as seen in marked long-term preservation of 'neurotic' habits of reaction that they themselves would rather be without. Motivated learning involves identification and recall of events and sequences - allowing whole chunks of behaviour to be copied or shifted around a person's repertoire. In some recent researches, people of higher neuroticism have shown better recall for the details of past events such as their first day at secondary school and their first kiss - regardless of whether they experienced these events as happy or stressful at the time (Brand, 1996/7). It is almost as if life means more to the more neurotic, more emotional person. Whether a high degree of storage for past events is helpful on a day-to-day basis will presumably depend on the degree to which the events were genuinely of importance and can have their features intelligently extracted on later demand. Presumably problems can arise from the overloading of consciousness with useless memories - which is what some people of higher emotionality seem to report.

The above five non-*g* -related ability distinctions can provide a serious hypothesis today to the variance that exists beyond the main human mental ability difference in *g* itself. For the past decade they have been the subject of what has been called a "converging consensus" in the field of personality research (using questionnaires that probably tap more crystallized aspects of them*(32)*). Still, the plain truth is that, seventy-five years after Binet's tests were translated and organized into a usable form by English-speaking psychologists in Stanford and London, and despite many psychologists having sympathized with Binet's own preference for 'going beyond general intelligence', there is astonishingly little agreement in psychology about such 'other dimensions' of ability at present.*(33)* Evans & Waites (1981, p183) expressed a common and long-standing aspiration of many psychologists to dispute the claim of the universal involvement of any *g* factor in mental abilities: apparently "comparatively recent findings" showed that "cognitive tests can in fact be devised which do not correlate with conventional psychometric tests." Yet *g* still held sway - as in the classic review of the field by Gustafsson (1984). Reviewing the recent literature of personnel selection research, Schmidt *et al.* (1992) note the continuing lack of support for non-*g* mental abilities: "Research evidence against differential aptitude theory mounts, leading to a renewed emphasis on the importance of general mental ability." Major North American psychometric programmes (e.g. Snow *et al.* , 1984) come up with little more than the faint empirical distinction between numerical, verbal and spatial abilities (normally correlating at .70 when reliably measured) that dates from Thurstone (1938) and which long ago inspired the Alice Heim Tests of intelligence that have proved so popular for testing high-level intelligence in Britain.*(34)* Even Howard Gardner, the foremost champion of multiple independent abilities over the past fifteen years, has been unable to deliver any package of demonstrably uncorrelated mental tests (e.g. Gardner, 1993a,c; Krechevsky & Gardner, 1994).*(35)* Nor has the enormous US Air Force programme of testing in Texas - using all the concepts and distinctions of modern cognitive psychology (working memory, declarative learning, procedural knowledge etc.) - realized empirically the multidimensional ambitions of J.P.Guilford (see Kyllonen, 1994).*(36)* Lastly, the long-standing wish of North America's leading academic entrepreneur for cognitive psychology (and for his own 'triarchic theory') to go beyond *g* has likewise yielded nothing that does yet do that job (see Sternberg, 1994).*(37)* Hence it seems preferable to invoke modern personality distinctions and strategic contrasts to provide the needed complement to the influence of *g* alone.

Interestingly, non-*g* differences such as the five contrasts suggested above are more easily seen in people of relatively high IQ (Brand, 1988; Detterman & Daniel, 1989; Lynn, 1992a; Detterman, 1993; Deary *et al.* , 1995/6).*(38)* At higher levels of *g* it can be said with better psychometric authority that some people really are more 'verbal', others more 'spatial', some more 'clerical' and others more 'creative', and so on. Self-reported personality features also seem to differ more sharply amongst higher-IQ testees - sometimes yielding more extreme scores and sometimes yielding new personality factors altogether (Brand, Egan & Deary, 1994; Brand, 1995). This may be the reason why so many psychologists - themselves presumably fairly high in *g* - find it easy to believe that there are many quite distinct types of intelligence and aptitude, and that they and their friends and colleagues all have numerous non-*g* -related intellectual strengths and weaknesses; and it accords with Binet's own view that intelligence was more unitary and thus more readily 'measured' in the below-average range.*(39)* Just why intelligence and intellectual styles should appear more 'differentiated'*(40)* at higher levels of *g* , Mental Age and IQ will be considered at the end of Chapter 2.

The striking central phenomenon, however, is twentieth-century psychology's overwhelming and continuing vindication of Binet's main finding - while not of Binet's or others' disunitarian ideas. To the surprise of many psychologists themselves, reliable tests of mental abilities intercorrelate positively and defy interpretation in terms of bias: Binet-type tests have repeatedly shown the meaningfulness of overall MA, and thus of *g* . Virtually all mental tests could serve to help indicate intelligence: as Binet and Simon (1911) themselves had put it, "It matters very little what the the tests are so long as they are numerous." Lack of grip on the larger aspects of mind had driven Watson and his followers to the study of the rat; but Binet's common sense and empiricism arguably netted the key reality of human mental differences. Like heat, intelligence has proved satisfactorily quantifiable; and measurement should yield the same sorts of advance as occurred in science and medicine after the development of the thermometer. Psychological understanding of this reality may have left much to be desired, as has often been complained; but theorizing and research are barely even attempted by those who are determined to doubt the reality of *g* . Rather than use the available thermometers, critics of IQ behave like alchemists who would smash their measuring tools rather than learn the truths they tell. Watsonian opposition to broad and central dimensions of human psychological difference has always been a luxury that psychology could ill afford; but to couple ideological behaviourism with accusations that 'no one really knows what intelligence is' adds hypocrisy to frivolity. It is simply wrong to talk of "the relatively small correlations that have been reported" between cognitive tasks (Russell, 1990). Binet provided the basis on which others could build - if and when they were so minded.

CONCLUSIONS

1. Many turn-of-the-century psychologists doubted that quantitative assessment of human faculties could advance psychology; but Binet realized Galton's dream of finding that most mental abilities are systematically related. To think that people thus differ in their levels of general intelligence (*g*) appeared a reasonable and economic way of summarizing the picture that Binet had first disclosed.

2. Other interpretations of 'the positive manifold' of mental ability correlations repeatedly make incorrect predictions. Notions that some testees lack motivation, concentration or high enough expectations of themselves predict that such testees (whether from low-SES groups or ethnic minorities) will perform poorly on virtually any test whatsoever. In fact, simple reaction times, motor skills and memory for nonsense syllables have little connection with *g* (i.e. with mental

ability tasks involving symbol use), so low-IQ testees perform perfectly well on them. The same positive relations are found between mental tests that require the use of symbols even when testees are all drawn from the same SES levels, from the same minority groups or from the same families.

3. Despite the omnipresence of *g* differences, most psychologists have envisaged that there are some additional tendencies to covariation among mental tests that allow talk of other, more specific mental abilities. 'Fluid' and 'crystallized' forms of *g* were first identified around 1930 - although only one person in eight in the general population will have scores that differ significantly on these two substantially correlated types of ability. Other more specific abilities certainly exist (e.g. for map reading, constructing objects from diagrams, and being verbally and ideationally fluent); but these still involve *g* or, when they do not, are irrelevant to capturing more than a small fraction of the practically important differences between random members of the population. Currently, despite decades of search for and belief in 'differential aptitudes', there is in fact no agreed nomenclature or scheme for abilities other than *g* even though terms like 'verbal', 'spatial' and 'clerical' are often heard. The 'Big Five' dimensions of personality have approached something of a consensus among modern psychometrician-psychologists. They probably come nearer than any other method to indicating the main human ability differences beyond those for which *g* differences can adequately account. The special links of the Big Five are to the ability-contrasts: verbal vs spatial; field independence vs field dependence; short-term memory vs long-term memory; originality vs accuracy; and conditionability vs extinctionability.

4. Even these bipolar distinctions may themselves be hard to isolate in testees of low general intelligence. Intelligence and personality seem more 'differentiated' in people who are above-average in g: though the *g* factor is unitary, higher *g* levels yield more diversity. Binet was right to suspect that differences in general intelligence were both more important and more measurable among the lower-IQ.

ENDNOTES to Chapter I

1. A child's 'social class of origin' would normally be thought to be determined by the status, wealth, income and influence of its parents. Typically parental socio-economic status is assessed by the 'level' of the father's occupation; or by some formula that essentially multiplies the father's income by his educational level.
2. Braden (op.cit.) especially considers the idea that minority children are handicapped in access to the ways of the 'dominant culture' - e.g. because their parents do not know it, do not like it, or anyhow cannot communicate it to their children; and thus that minority children will be deficient in the knowledge which is sometimes thought to be especially tapped by IQ-type tests. By such criteria, deaf children clearly have a massive handicap in accessing the 'dominant culture'; yet they have entirely normal levels of gf.
3. Afro-Caribbeans in America and Britain have been of particular interest concerning the validity of tests. Whereas some ethnic minorities have their own language, religion, trade specializations and musical preferences, blacks in America and Britain are very similar in their general cultural exposure and aspirations to local white populations. Yet blacks show *g* deficits - especially on those *gf* tests that are the least conspicuously dependent on 'culture' (and which give higher IQ estimates for white children from poor families).
4. Schonemann (1985) claimed there might be artefacts of test construction that would lead to minority groups doing poorly on IQ-type tests. But Braden (1989) found that deaf children - who are notably isolated from mainstream American culture and stigmatized by their peers - only have problems with verbal IQ tests. It is precisely on verbal tests that black children typically do rather well - compared to their overall IQ results.
5. Larry P *et al.* v. Wilson Riles *et al.* , US District Court (Northern California) Judge's Opinion, filed 16 x 1979, p.3.
6. Rosenthal & Jacobson (1968) provided the sensational initial report of labelling-induced IQ-'blooming' in six-year-olds; but their effect was achieved only with very young children on a most unusual test - which classified most of the children as mentally subnormal even though they were in a normal school; anyhow, the 'Pygmalion effect' proved hard to replicate for IQ. Rosenthal (1994) himself reviews the extensive literature and estimates that expectancy effects achieved for combined tests of 'ability and learning' average (in correlational terms) only .26.

Since no 'learning tests' are as reliable as IQ - and thus unlikely to reflect such short-term influences as expectancy effects - the Pygmalion effect for IQ has to be still lower.

7. Replacement of unfair tests and items could occur by finding items on which the lower-IQ racial minorities perform relatively well. Such items can be found: for example, black people do relatively well on tests of simple reaction time and rote memory. However, the problem is that not even IQ's sternest critics think these tests measure intelligence.
8. There is the Differential Aptitude Test, of which disunitarian theorists entertained so many hopes over the years - but its sub-scales typically correlate at around .35.
9. It is often thought that there are many different 'cognitive abilities' that must have been identified in the last twenty years work since experimental psychologists forsook the rat and once again studied people. However, cognitive psychologists normally study psychology students or other educated young people who do not differ much in g: thus many of the variables of the cognitivist's laboratory have simply not been investigated as to how they correlate with *g* . Exceptionally, where cognitivist investigators have made the proper investigations, their measures of attention and memory correlate substantially with *g* - see Chapter II. Johnson-Laird (see Johnson-Laird & Byrne, 1993) has distinguished some five different types of thought which bear some resemblance to the five non-*g* dimensions of difference that Chapter I outlines. Again, the first two of the five dimensions set out here (Verbal vs Spatial, and Analyticity vs Synthesis) closely resemble the two distinguished in a substantial review of how other mental tests correlate independently of the *g* factor of the classic Raven's Matrices (Carpenter *et al.* , 1990).
10. Many studies admittedly involve all too slight a range of IQ's. For example, in the largest single project on personality differences in 'normal adults', in Baltimore (e.g. McCrae & Costa, 1989), no less than a quarter of the adult testees have doctorates. Such artificial restriction of *g* range allows 'special' factors to appear as relatively important compared to *g* .
11. Researchers of personality do not invariably look for underlying abilities - partly by theoretical choice, and partly because testing abilities is more demanding of subjects. On the other hand, researches of abilities tend to feel there is little point in administering questionnaires when these produce results that are much less reliable and predictive than are ability measures (especially when ability measures tap into *g* variance, whether by accident or design). Thus, bizarrely, 'intelligence' and 'personality' are conventionally treated as separate domains by most researchers. Over the years, Cattell has provided the one conspicuous exception: his personality questionnaires always include an intelligence scale.
12. The task is similar to that seen in children's comics, where the child has to find, say, how many 'monkeys' can be detected in a drawing of people on crowded beach. Finding relevant detail embedded in irrelevant material often figured as one of the primary factors found by follower of Thurstone - see Baker, 1974, p.455.
13. Dempster(1991) summarizes evidence linking field independence to Wisconsin Card Sorting (when testees are required to change sorting principles throughout the test) and to the Stroop task (where testees have to avoid distraction from the colour in which a colour word is printed - e.g. 'blue' printed in red takes longer to read than 'blue' printed in blue).
14. For the idea that there is a trade-off relation between storage and current processing of information, see Just & Carpenter,1992. Very stiking extravert-introvert differences occur in response to the McCullough Effect (whether subjects easily see phantom colours after viewing black-and-white grids (Logue & Byth, 1993)). These differences apparently reflect differences in the functioning of the cholinergic fibres that are known to be involved in enabling consolidation of memory traces.
15. For an account of the range of effects in which something like classical conditioning may be involved, see Turkkan, 1989 and Krank, 1989.
16. In questionnaire research, the five dimensions are currently known by such titles as:
    - (i) Openness, affection (a), tender-mindedness vs realism, cynicism, projected hostility
    - (ii) Independence, will (w), disagreeableness vs subduedness, deference.
    - (iii) Extraversion, energy (e), surgency vs introversion, gravity, sobriety.
    - (iv) Control, conscientiousness (c) vs laxity, impulsivity, casualness.

17. (v) Emotionality, neuroticism (n) vs stability, sluggishness, composure.
18. The *g* dimension quite often fuses with Openness/Tender-mindedness to yield a factor that is usually called Intellectance. See e.g. Deary & Matthews 1993; Brand 1984,1994a,1994b.
19. That is to say that, despite the best intentions of both critics of *g* and of defenders who would deem it wise to admit some non-*g* variance, there is simply not a single psychologist or publishing house in the 1990's issuing mental tests that are at once (1) reliable, (2) of proven predictive power for a range of important human achievements, and (3) uncorrelated with *g* when given to representative samples of the population. Such is the extent of the calamity for 'disunitarian' theorists wishing there were a wide variety of abilities so that all could, by happy chance, be good at something. Full modern evidence for the overwhelming paramountcy of the *g* factor is set out by Carroll (1993) (and summarised by Brand, 1993). Carroll admittedly talks of there being seven second-order ability factors that are distinguishable once a third-order *g* factor is removed. However, (i) along with gvisual, gauditory, gspeed, gidea-production, and gmemory, Carroll's seven factors include *gf* and *gc* which

plainly are not generally independent and thus cast great doubt on the independence of the other five; (ii) Carroll's seven show no more correspondence with the schemes of other psychologists than would be expected from the five ability contrasts selected in this Chapter. Carroll's scheme has a family resemblance with those of R.B.Ekstrom and J. Horn (see Kline, 1992); but the schemes of Ekstrom and Horn also suffer classically from a tendency to claim as independent and distinguishable factors that are well known for the ease with which they are found to correlate in studies involving the full range of the general population. (For example, Horn & Noll (1994, p.189) claim factors of *gf* and *gc* to correlate at only .19 "based on 154 7-year-olds"; and they suppose that *gf* and *gc* "stem from different genetic determinants, the effects of which can be seen early in development." However, the "7-year-olds" had all been in intensive care as neonates (though Horn & Noll think it "unlikely" that this would have made them atypical of normal development); and Horn and Noll cite virtually no evidence since 1980 to support their disunitarian claims.)

20. As Baker (1974) once put it: "Among those who allow the existence of semi-specific primary factors or group factors, general agreement has not been reached as to the number of them that should be recognized...."
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24. The general idea that differentiation occurs at higher levels of ability, maturation and social enrichment has a history going back to 1919: for a review see Anastasi, 1970. That 'parallel' IQ-type tests do not give such closely similar results in testees of above-average intelligence was especially remarked by Terman & Merrill (1937, pp. 44-47). It could be that IQ tests are less reliable outwith the ranges for which they were primarily designed (as is suggested by Spitz, 1986, pp.45-53). However, the phenomenon of differentiation occurs in ratings as well as in tests: when three raters estimated the IQ's of eminent and creative men, their IQ estimates were closer for eminent men of mediocre intelligence than for those for whom the average of the three ratings was higher (Cox, 1926, p.54 pull-out supplement). It is just as likely that differentiation of intelligence makes for lower correlations between tests as that some intrinsic unreliabilty accounts for the many observations of differentiation.
25. People's friends will be similar to themselves in IQ and educational level: thus higher-IQ people will have more experience of people in whom intelligence has differentiated into some specialized forms of intelligence and not into others. Binet & Simon (1908, trnsl. R.E.Fancher) remark: "We are of the opinion that the most valuable applications of our scales will not be for the normal, but instead for the inferior degrees of intelligence." In the USA, Wissler (1901, pp. 54-55) had drawn a similar conclusion that tests of weight discrimination, two-point threshold and colour naming had greater inter-correlation (and thus most to offer as indicators of intelligence)

"when applied to children in the lower schools."

26. i.e. 'differentiated' into different types of mental ability. The idea is that dimensions such as the five non-*g* - dimensions outlined earlier will emerge more clearly - as distinct from each other and from *g* - among testees of above-average intelligence.
27. Researchers of personality do not invariably look for underlying abilities - partly by theoretical choice, and partly because testing abilities is more demanding of subjects. On the other hand, researches of abilities tend to feel there is little point in administering questionnaires when these produce results that are much less reliable and predictive than are ability measures (especially when ability measures tap into *g* variance, whether by accident or design). Thus, bizarrely, 'intelligence' and 'personality' are conventionally treated as separate domains by most researchers. Over the years, Cattell has provided the one conspicuous exception: his personality questionnaires always include an intelligence scale.
28. The task is similar to that seen in children's comics, where the child has to find, say, how many 'monkeys' can be detected in a drawing of people on crowded beach. Finding relevant detail embedded in irrelevant material often figured as one of the primary factors found by follower of Thurstone - see Baker, 1974, p.455.
29. Dempster(1991) summarizes evidence linking field independence to Wisconsin Card Sorting (when testees are required to change sorting principles throughout the test) and to the Stroop task (where testees have to avoid distraction from the colour in which a colour word is printed - e.g. 'blue' printed in red takes longer to read than 'blue' printed in blue).
30. For the idea that there is a trade-off relation between storage and current processing of information, see Just & Carpenter,1992. Very stiking extravert-introvert differences occur in response to the McCullough Effect (whether subjects easily see phantom colours after viewing black-and-white grids (Logue & Byth, 1993)). These differences apparently reflect differences in the functioning of the cholinergic fibres that are known to be involved in enabling consolidation of memory traces.
31. For an account of the range of effects in which something like classical conditioning may be involved, see Turkkan, 1989 and Krank, 1989.
32. In questionnaire research, the five dimensions are currently known by such titles as:

Openness, affection (a), tender-mindedness	vs	realism, cynicism, projected hostility
Independence, will(w), disagreeableness	vs	subduedness, deference.
Extraversion, energy (e), surgency	vs	introversion, gravity, sobriety
Control, conscientiousness (c)	vs	laxity, impulsivity, casualness.
Emotionality, neuroticism (n)	vs	stability, sluggishness, composure

The *g* dimension quite often fuses with Openness/Tender-mindedness to yield a factor that is usually called Intellectance. See e.g. Deary & Matthews 1993; Brand 1984,1994a,1994b.

33. That is to say that, despite the best intentions of both critics of *g* and of defenders who would deem it wise to admit some non-*g* variance, there is simply not a single psychologist or publishing house in the 1990's issuing mental tests that are at once (1) reliable, (2) of proven predictive power for a range of important human achievements, and (3) uncorrelated with *g* when given to representative samples of the population. Such is the extent of the calamity for 'disunitarian' theorists wishing there were a wide variety of abilities so that all could, by happy chance, be good at something. Full modern evidence for the overwhelming paramountcy of the *g* factor is set out by Carroll (1993) (and summarised by Brand, 1993). Carroll admittedly talks of there being seven second-order ability factors that are distinguishable once a third-order *g* factor is removed. However, (i) along with gvisual, gauditory, gspeed, gidea-production, and gmemory, Carroll's seven factors include gf and gc which plainly are not generally independent and thus cast great doubt on the independence of the other five; (ii) Carroll's seven show no more correspondence with the schemes of other psychologists than would be expected from the five ability contrasts selected in this Chapter. Carroll's scheme has a family resemblance with those of R.B.Ekstrom and J. Horn (see Kline, 1992); but the schemes of Ekstrom and Horn also suffer classically from a tendency to claim as independent and distinguishable factors that are well known for the ease with which they are found to correlate in studies involving the full range of the general population. (For example, Horn & Noll (1994, p.189) claim factors of gf and gc to correlate at only .19 "based on 154 7-year-olds"; and they suppose that gf and gc "stem from different genetic determinants, the effects of which can be seen early in development." However, the "7-year-olds" had all been in intensive care as neonates (though Horn & Noll think it "unlikely" that this would have made them atypical of normal development); and Horn and Noll cite virtually no evidence since 1980 to support their disunitarian claims.)
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II Difference in Development - *the psychological bases of g differences*

- *The London and Geneva Schools of thought about intelligence*
- *Spearman, factor analysis and g differences*
- *Piaget's constructivist account of development*
- *Mental intake speed (especially Inspection Time)*
- *Explaining 'differentiation' of abilities at higher g-levels*

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OUTLINE

If there is something that lies behind many of the differences between people in comprehension and knowledge, what is its nature? There have been two main traditions of theorizing about the nature of intelligence. The 'essentialist' tradition of Charles Spearman and the London School holds general intelligence (g) to be a true mental power that is a key resource for most cognitive activity. This power differs quantitatively between individuals; and its level changes within an individual as a result of biological maturation and decline - or even because of shorter-term changes that drugs may one day mimic. By contrast, the 'constructivist' tradition of Jean Piaget and the Genevan School is that intellectual capacities develop as children change their ideas ('schema') to accommodate their increasing experience of reality - rather as scientists alter theories to enhance their range, economy and predictive power. Individual differences in childhood are interpreted by Piagetians as maturational delays that will be remedied as children continue to interact with the environment.

After examining these traditions and the problems of demonstrating their adequacy, modern work on 'mental speed' is considered. Though cognitive psychologists initially disdained them as unpromising, measures of speed-of-intake of elementary information now have behind them a twenty-year record of research into their correlation with IQ differences. The technique of 'inspection time' (IT) testing is particularly discussed, along with other tasks (such as 'paced serial addition' and letter-reading speed) that mainly reflect differences in speed of extraction of information. If intake speed actually underlies intelligence, some of the developmental problems left by Spearman and Piaget can be resolved; alternatively, if a fast intake speed results from intelligence, this shows at least that *g* is of wider significance and is more closely linked to perception than if *g* were only 'academic intelligence.'

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Watson and Binet differed radically in the use they had for the concept of intelligence. Watson had proposed how to condition and extinguish habits without regard to intelligence at all; while Binet had shown how to assess the level of a child's mental development - to which an educator would need to

adapt. Yet these pioneers of applied, improvement-oriented psychology shared an important theoretical agreement - on a negative. Though for different reasons, neither thought of intelligence as a definable mental entity. Watson, the empiricist, shunned abstraction; and Binet, more alert to how 'science' can sanction mere ideas and words, doubted that IQ numbers had any 'real' basis. By the end of his work, Binet's concept of intelligence, far from pinning it down, emphasized its breadth. In 1911, Binet wrote "Comprehension, invention, direction and criticism: intelligence is constrained in these four words" (Fancher, 1985). No more than Watson did Binet possess or want a theory of what intelligence was.

Early attempts to define intelligence as "judgment", "adaptability to new situations", "the eduction of relations", "the capacity to acquire capacity" produced no agreement at the first big American conference on intelligence testing in 1922 (Spearman, 1923, Chapter 1; Siegler & Richards, 1982, p.90). Yet psychology could not long remain content with intelligence being simply "whatever the tests test" - which E.G.Boring (soon to be America's leading professor of psychology) had articulated as being the fall-back position. The achievement of reliable, unbiassed and predictive measurement necessarily invites theorizing about what is being measured by an instrument. This may be relatively easy to specify - though even weight and temperature are not without complications for scientists as to what they really are. Or it may be intrinsically complex and involve much more, even on the surface, than is captured in numbers - as when levels of female sexual attractiveness are quite readily agreed by males while leaving researchers little the wiser about 'what attractiveness really is'. (Only lately has it become clear that beauty can be created and exist independently of ever having been perceived: for males will rate as most attractive composite photos of women's faces that involve novel exaggerations of characteristics which males generally favour - such as wide eyes, fuller lips and gracile chins (Perrott et al., 1994).) Within a few years of the development in the USA of the Stanford-Binet Test, the two main theories that were to dominate the twentieth-century psychology of intelligence were being put on show. One was championed in University College London by Charles Spearman (1863-1945); and the other was conceived by the Swiss psychologist, Jean Piaget (1896-1980) - working first at Binet's former laboratory in Paris and then, from 1929, in the Jean Jacques Rousseau Institute of Geneva.

The London and Geneva schools diverged in their subjects (adults, young children), methods (group testing, individual testing) and focus (difference amongst age peers, development across age ranges). Yet they agreed about Binet's discoveries, about the unity and generality of intelligence (whether or not they used Spearman's symbol '*g* ') and about the unlikelihood of intelligence being 'learned'; and there would be no set-piece battles between them. It was the ideas of Spearman and Piaget that differed profoundly. Interestingly, in view of the London School's subscription to the hereditarian ideas of Sir Francis Galton, it was Piaget who was the more 'biological' and evolutionary in his approach; by contrast, Spearman inclined to view general intelligence as a specifically human feature - as symbolic intelligence largely is. At the same time, both men were markedly idealistic, given to rumination and complexity of thought (quite unlike Watson), and concerned to acknowledge human intelligence as an active causal force in the world and to establish a psychology that was relevant to man's spiritual nature, agentic status and high moral quest.

Charles Spearman was a well-born, serious and high-minded British Army officer who resigned his commission in mid-career to pursue his interest in the nature of human consciousness. Opposed to any idea that human learning occurred by mere association and retention, Spearman wanted to show the role of "the mind or 'soul' as the agent in conduct" (see Evans & Waites, p.56). After seven years of study for a PhD with Wundt, in Leipzig, he came across Galton's ideas and the technique of correlation. Spearman soon made the first of his own methodological breakthroughs in statistics by developing a method of finding the 'true correlation' between two variables; and this paved the way for his development of the technique of factor analysis.

Spearman made allowance for the unreliability of variables (often considerable in psychology, especially where single items are concerned) by using variables' reliability correlations (multiplicatively) in the divisor of the correlation between them: thus, the poorer the reliability of the

variables, the higher was the 'true' correlation between them after correction. (Spearman's point was that if tests X and Y correlated at .50 while the reliability of Test X was only .50, the X/Y *r* was as high as the reliability of X could possibly allow. In this case (assuming Y's reliability was an unproblematic 1.00) it could be said that the 'true' correlation, between whatever X 'truly' measured and Y was .50 / (.50 x 1.00) = 1.00.) Likewise, Spearman noticed a way of correcting correlations (*r*'s) for any restriction of range in the variables involved. When only some narrow subsection of a population is used, as when psychologists study students for convenience, *r* 's between mental tests will be 'attenuated'. This is because test unreliability will be responsible for a larger percentage of the individual differences in test scores than it would in a study involving a normal (and thus wider) range of IQ's. Correlations between variables are higher when the full range of the variables is used because data points then involve greater relative reliability: by way of illustration, an IQ of 160 will be reliably different from the IQ's of many more people in the population than will an IQ of 106. The effect of attenuation in research is substantial: for example, *r* 's of .70 in the normal population will be attenuated to .45 if a study involves subjects in only one half of the IQ range (e.g. over or under IQ 100) (see e.g. Detterman, 1993). Researchers will miss a lot when they cannot study collections of people who range normally along the dimensions with which they are concerned.

Spearman's development of the technique of *factor analysis* is another extension of the basic idea of estimating what correlations between variables would have been if other statistical influences - particularly, those detectable via other correlations - had not been at work.*(1)* It is rather as in the process of factoring in algebra, where complex expressions are simplified by extracting the common multipliers of all terms. In outline, factor-analytic procedure is as follows.

1. Working from a matrix showing all the *r* 's*(2)* between tests, factor analysis first sums each variable's *r* 's with all the other variables. These sums are added together to yield the *sum of sums* - which is the total covariance in the study. (*Covariance* is the technical term for 'the going-together, or overall intercorrelation, of variables with each other'.) Factor analysis then ascertains each variable's proportional contribution to this covariance: each variable's sum (of its own *r* 's) is divided by the total covariance. The resulting *factor* (the 'first factor') is simply a list of these contributions to the square root of the sum of sums from all the variables. Figure II,1 provides an example.

   Figure II,1: Extracting the first factor from a correlation matrix.

The correlation matrix

Tests ⇒ ⇓	A	B	C	D	*Sums of r's* ⇓	*Sums divided by sqare root of Sum of sums* ⇓		*Factor loadings* ⇓
A	(.72)	.72	.51	.26	2.21	2.21 / 2.63	=	.84
B		(.72)	.40	.30	2.14	2.14 / 2.63	=	.81
C			(.51)	.15	1.57	1.57 / 2.63	=	.60
D				(.30)	1.01	1.01 / 2.63	=	.38
			Sum of sums =		6.93			

   Note: The *r* 's in brackets, in the 'leading diagonal' of the *r* matrix duplicate the highest correlation of each variable with any of the others so as to provide estimates of how well each variable correlates with itself. Such 'communality estimates' allow inclusion of each variable's own unique variance when estimating its contribution to overall covariation.

2. Some variables will have had greater intercorrelation with all the other variables and will thus

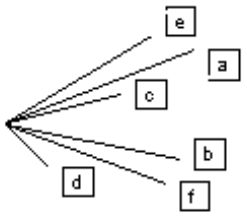
have contributed more to the covariance These variables are said to be especially *loaded on* (i.e. correlated with) the first factor and they are the most important in any attempt to interpret the nature of the factor. (Usually these high-loading variables will have correlated especially strongly among themselves - as did Tests A and B in Figure II,1.)

3. Using these proportional contributions (the loadings) of the variables, this source of variance (the factor) is deducted (*extracted*) from the original correlations. (Each *r* loses the product of its two constituent variables' loadings on the first factor: in Figure II,1, the revised *r* between A and B would drop to .72 - .84 x .81) = .04.) If any statistically significant correlations remain in the matrix, the factor analytic process is repeated to extract new, independent factors.

4. Resulting factors are then evaluated. In the analysis of mental abilities, which invariably correlate positively and substantially, the first factor - usually assumed to be the *g* factor - normally turns out to account for at least twice as much of the variance in the original matrix as do all subsequent factors put together. However, by multiplying variables' factor loadings, it is possible to calculate the *r* 's that would have occurred between variables if only two factors had been at work - e.g. perhaps the *g* factor and one other; and then to find a new single first factor that would account best for such hypothetical *r* 's. In this way, factors can be hypothesized that redistribute variance from *g* and a specific - perhaps from *g* and a specific 'vocabulary' factor - to a blending factor that might itself provide a good indicator of 'verbal ability'. (A preference for identifying such blended factors guided the work of Thurstone and Guilford; and to this day Gardner continues the search - see Chapter 1. But it is hard to keep blended factors both well-defined by particular tests and independent of each other: this is because mental tests involve *g* to such a great extent, as compared to specific factors.)

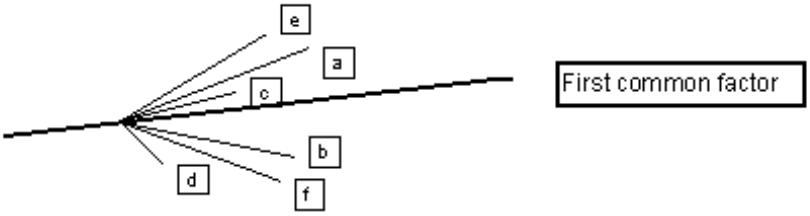
One way of understanding what factor analysis achieves derives from the fact that a correlation between any two variables can be represented as the angle made by two straight, intersecting lines. A correlation will usually be represented as the cosine of the angle between two vectors: thus two lines at ninety degrees will stand for zero correlation; and two lines at 45º will stand for a correlation of +.71. Further variables may be represented by further lines that make stipulated angles with the previous two lines - though it may be necessary after a while to move into three or more spatial dimensions. Figure II,2A shows six variables that have various degrees of positive correlation with each other. Shorter lines are used to represent divergence into a third dimension.

Figure II,2A Geometrical representation of correlations between variables. (E.g. Variable a correlates very highly with e, about .70 with b, less with c; and least with d)



The resulting picture is as of a cross section of the spokes of an umbrella - but in a drawing from which the handle of the umbrella has been omitted. In terms of this analogy, finding the first factor would be equivalent to estimating where, in the drawing, the handle of the umbrella should have been drawn - see Figure II,2B.

Figure II,2B Geometrical representation of a first common factor (which would itself correlate as highly as possible with as many of the original variables as possible).



By successive extraction of factors, the analysis 'accounts' as economically as possible for the individual differences that have yielded correlations (usually including the correlation of each test with itself). In particular, it accounts for the differing degrees of correlation that are found amongst test items (or packages of items).

As his new career developed, Spearman became increasingly involved with those human mental abilities that could be measured and studied, and thus, in due course, with Binet's tests. These he judged a "hotchpot" - though still a practical one that he presumed to measure intelligence because the specific, non-intellectual elements in Binet's many items cancelled each other out. Spearman (1916) would resist the view (to be championed by the Edinburgh psychologist, Sir Godfrey Thomson (1916)) that tests X, Y and Z might all inter-correlate for quite different reasons: Thomson's theory (of 'multiple bonds') required distributions of correlations that were hugely improbable and would have to predict the eventual discovery of uncorrelated mental tests - some tapping only the abilities required for X and Y, and others tapping only the abilities required for Y and Z, and for X and Z.*(3)* Spearman's own analyses began with simpler tests that he hoped would realize Galton's dream of being underlying abilities that provided (at least in part) the psychological basis of all forms of intelligence. In 1904, Spearman had published data from village school children showing that sensory discrimination (for pitch and hue) and attentional readiness were 'truly' well correlated - once his correction for measurement error was made. Spearman's data had suggested to him that the ability to take in even the simplest information about physical objects might be responsible for people's differences in intellect. However, Spearman could not prove it. In particular, the Columbia psychologist, E.L.Thorndike (1874-1949), argued against him that, on the contrary, general intelligence might assist even sensory acuity (on standard tests). Moreover, although Binet's tests were 'complex' and of less immediate theoretical interest, they had the merit of yielding strong correlations with teacher's judgments without any correction for unreliability at all. By 1909, therefore, Spearman compromised with Thorndike and supposed that children's differences in both sensory discrimination and teacher-assessed intelligence would be "based on some deeper fundamental cause" (see Deary, 1994a) - and thus need not themselves correlate strongly.

Once Binet's practical achievement was clear, Spearman became especially concerned to identify what there was in common among Binet's "gallimaufry" of "multitudinous tests" Spearman's concern was with the variables that typically loaded substantially on the first and biggest factor found in mental ability correlations.*(4)* It was Spearman who christened this the *g* factor: he was mindful of physicists' use of *g* for the Newtonian constant of gravity, and he thus expressed his hoped of delivering a 'physics of the soul' (*physicae animae*, Spearman, 1923)). Across his factor analyses, it turned out that the truest measures of intelligence - correlating as highly as possible with all the others and thus with the *g* factor - were those in which the testee had to handle the most abstract relationships. The relationship of X 'being essential to, involving, or being defined by' Y is of this kind: e.g.

BIRDS are to WINGS as CASTLES are to: GUNS / FLAGS / BATTLES / WALLS ?
PIGS are to BOARS as DOGS are to: LIONS / SHEEP / CATS / WOLVES ?

However, reflecting his earlier theoretical proclivities, Spearman was inclined to think that the ability to handle abstract relationships was determined primarily by some kind of 'mental power': this 'energy' would be in particular demand for working out (i.e. inferring) abstract relations, but was also necessary in varying degrees to drive other 'mental engines' as well. Thus Spearman came to play

down the involvement in intelligence of "the apprehension of experience" and to emphasize "the eduction of relations and correlates."

Spearman anticipated the idea that there might be general laws about human information processing and he could be called the first cognitive psychologist. (It was only in the 1960's that academic psychologists would interest themselves in 'information processing capacities', and only in the 1970's that they would claim their chief interest as being, like Spearman's, in cognition.) In particular, Spearman's idea that mental energy might be more important for novel than for practised tasks anticipated Cattell's distinction between fluid and crystallized intelligence (see Chapter 1). Spearman also observed the greater 'differentiation' of intelligence (i.e. the lower correlations between different types of test) at higher levels of *g* (see Chapter 1): he referred to differentiation as a 'law of diminishing returns' whereby "the more energy a person has available already, the less advantage accrues to his ability from further increments of it" - rather as a ship's speed is not doubled by doubling the coal in its boiler (Deary & Pagliari, 1991). Yet Spearman was frustrated by events of his day. Following the Leipzig tradition of concern with reaction times, explorations were occasionally made of the relation between reaction speeds and IQ; but no promising correlations were discovered. Eventually, after big promises from James McKeen Cattell, Wissler's (1901) analysis of McKeen Cattell's data received much attention: the correlations between academic knowledge and laboratory abilities turned out to be slight - though chiefly because of restriction of range around what would probably have been very high average intelligence in McKeen Cattell's undergraduate testees.*(5)* Reflecting what were becoming lowered expectations of such 'simplistic' approaches, even a study by Spearman's young admirer (and eventual successor at University College London) was not followed up. Cyril Burt (see Chapter III) (1909) reported superior performance at recognizing briefly illuminated 'spot patterns' by those Oxford children having higher teacher- and peer-rated intelligence (several of them the sons of dons and bishops); but his paper was to be overshadowed by Binet and Simon's work and would sit unremarked in the psychological literature for seventy years.

Spearman's concern was with the full grandeur of intelligence and, though he wished to consider it as deriving from some kind of 'energy', he had to be impressed by the decisive results of what was, after all, the equally important search for good, practical measures of intelligence. Usually it appeared that it was the more complex items were best at measuring intelligence - and studies of brain damage in rats would eventually confirm the greater impact of such damage on the learning of those mazes that were more complex (Lashley, 1929). Spearman was thus to remain a central theorist and methodologist in the intelligence test movement; and his enduring memorial was the classic multiple-choice test of *g* developed by his Scottish student, John Raven, from Spearman's illustrations for teaching purposes of how abstract reasoning can be used to complete spatial designs (as in Chapter 1, Figure I,2) by 'the eduction and relation of correlates'.

Yet Spearman's clarification of the centrality of reasoning to measured intelligence did not fulfil Galton's dream of finding the most basic manifestations and the developmental origins of intelligence differences. In appreciating the role of *g* in detecting and making use of abstract relations, Spearman had shifted the emphasis from the simpler processes of apprehension with which his work had begun. While Spearman and his London School followers were emphatic that intelligence 'really exists', and even that children's differences should be nationally registered on an "intellective index" which could help determine the right to vote (Hart & Spearman, 1912; Spearman, 1927), their failure to discover more about its 'essence' would prove an enduring problem. By the end of Spearman's life, American psychologists were following the lead of the Chicago psychometrician, Louis Thurstone (1887-1955) in trying to break *g* up into separate components - even though Thurstone (e.g. 1946, p.110) himself admitted that his separate components were invariably correlated and that "there seems to exist some central energizing factor which promotes the activity of all these special abilities." (In the above Figures II 2A & B, Thurstonian procedures might involve driving one factor through variables e, a and c and another through b, d and f. This is perfectly legitimate mathematically as a way of describing correlations amongst variables; but what is usually forgotten by psychologists who settle for such multiple 'oblique' (correlated) abilities is that the *r* 's between the oblique factors remain to be explained.*(6)*) Spearman's *g* factor will usually account for some fifty to sixty per cent of the covariance between abilities - as even critics admit

(Gould, 1981); but its 'reality' was Platonic rather than Aristotelian - it lacked substantial underpinning from more basic psychological (or physiological) processes. The case for talking of *g* could easily survive attempts to interpret it as resulting from biases (Chapter 1) and to break it up into many different components: despite the efforts of Thurstone (and, later, of J.P.Guilford (1959), with his 150 proposed abilities) positive correlations persisted between all mental abilities that were at all reliable).*(7)* Nevertheless, the dream of Galton and Spearman remained unrealized: any elementary bases of *g* differences had still to be found.

Like Spearman, Jean Piaget was exercised by the largest problems about human nature. His interest in the role of 'the dynamic flux of consciousness in evolution' had led him, as a gifted adolescent, to an interest in animals that he was able to indulge when appointed to a zoo curatorship before going up to university. Piaget's adult career followed a path almost as stony as Spearman's; but eventually, as behaviourism declined, he enjoyed some two decades of popularity with educators and developmental psychologists in the English-speaking world.

Piaget's central idea was that human intelligence was not some elusive form of energy, but rather a developmental construction. Through childhood, according to Piaget, we go through stages and styles of operation - as the whole human race may have done in evolution - and gradually resolve the problems that we encounter as a result of our earlier, immature approaches. For example, we come to reject our early, simple assumptions that bigger objects will be heavier, or that taller containers will tend to hold a greater volume of liquid. Piaget's notion (following the mighty Königsberg philosopher, Immanuel Kant (1724-1804)) was that developed human intelligence involves a set of 'constructions' that are virtually bound to arise as we move through childhood encountering problems for our theories about the real world and having to come up with better answers. Eventually, by mid-adolescence, most children have abandoned the risky mental short cuts; so they arrive at the stage of being able to understand 'formal', logical operations that involve symbolic reasoning. For Piaget, the growth of intelligence was a developmental journey on which humans are all equally embarked; so a veil could be drawn over children's markedly different individual rates of progress, and indeed over the fact that many adolescents never reach the stage of 'formal operations' at all. Just as agreeably, Piaget claimed that human intelligence - i.e. the intelligence that we almost all have as adults (a Binet Mental Age of at least eleven years) - develops interactively ('in interaction with the environment'). No one but the most hard-bitten behaviourist would ever have doubted that some kind of curiosity-driven exploration of the environment would be one important part of the developmental process; but Piaget's followers were especially attracted to the notion because it seemed an alternative both to the behaviourist's idea that the environment 'shapes' and 'conditions' us and to the crudely hereditarian idea that we are quite directly the products of our genes. (Piagetians did not always understand that genes can be expected to have their own causal influences partly by yielding people's selection of and response to particular environments - see Chapter III.)

After behaviourism began to wear thin in academic psychology, around 1965, the first of these attractions, the 'egalitarian' stress on how all children develop rather similarly found a welcome in America. Contrary, in fact, to Piaget's own expectations, American psychologists believed that Piagetian ideas would lead to the hoped-for educational accelerations that had eluded behaviourists. However, the price was that Piagetian ideas would no longer be spared exposure to the large-scale empirical approach; so American and Canadian psychologists were soon producing the first reports indicating that 'Piagetian intelligence', far from being the non-g intelligence so often sought by psychologists, correlated perfectly well with traditional IQ, and especially with measures of fluid, untaught, general intelligence (*gf*) (see Tuddenham, 1970; Steinberg & Schubert, 1974; Kuhn, 1976; Humphreys & Parsons, 1979; Willerman, 1979, pp.98-99; Carroll et al., 1984). For example, Raven's Matrices and the Wechsler Intelligence Scale for Children correlated with Piagetian measures of conservation, seriation and class inclusion as highly as the reliabilities of the latter would allow - and as high as .80 when Spearman's correction was applied.*(8)* The history of the other favourite Piagetian view, as to the importance of 'interaction', is of another bumpy grounding of a big idea. At first, interaction had an apparently unfalsifiable status: for what reasonably intelligent child could be

found that had not 'interacted with the environment'? Yet the facts gradually broke in: normal intelligence is found in many children whose cerebral palsy or spina bifida drastically limited their ability to 'explore' or 'interact with' their environments.

The most striking case of 'interactionless intelligence' is the 99% palsied young Irish poet, Davoren Hanna (1990). Hanna had no capacity for voluntary movement at all - until age six when his mother noticed that he could sometimes squirm and fall off her lap in one direction or another. Soon he mastered the skill of falling forward with a finger pointing towards, say, 'an apple' on the floor; once shown letters, he quickly learned to fall in the direction of keys on an alphabet board. On an 'interactionist' account of intelligence, he should have been profoundly intellectually deficient. Yet by age eleven Hanna was writing affecting poems which soon won him international recognition: understandably, since he had often been recommended for lifetime institutionalization, one poem, 'The How the Earth Was Formed Quiz', concerned being 'tested' by psychologists who showed little recognition of his abilities or emotions. At thirteen he answered a journalist who asked if he knew anything about Moscow by saying Moscow had "the best red cabbage you'll find outside Chicago, long queues and poncey ballet dancers". As with many motorically disabled children, the most severe restrictions on 'interaction with the environment' had not in fact impaired his intelligence.

The grandest ideas of both Spearman and Piaget were thus hard to vindicate. Spearman and his followers could not pin down and quantify the capacity for experiential 'apprehension', let alone the 'energy' that Spearman claimed to 'fuel' all intelligent performance. For their part, Piaget and the Piagetians could not hide, circumvent or explain lasting individual differences in *g* ; and they could not demonstrate that ceaseless, 'constructive' developmental interaction was in fact necessary to normal intelligence - though none would doubt that interaction with the environment is often a *result* of intelligence. Nor could any particular differences between children in Piagetian 'interaction with the environment' be shown to yield the lasting individual differences in IQ that required explanation; and even Piaget's claims as to what were the main 'stages' of development came to be so qualified by the researches of his English-speaking followers as to leave little but Binet's premise that children's intelligence increases with age. Certainly, Spearman and Piaget provided psychologists with escape from the straitjacket of Watsonian environmentalism and from Binet's unwillingness to theorize at all. Followers of Spearman were free to recognize general human individual differences that did not seem to result mainly from differences in opportunity to learn; and Piagetians were free to say that child development owed more to maturation (and indeed to consequent interaction with the environment) than to being conditioned. Yet what was it that differed as between age peers - yielding countless effects on educability? What was it that matured? What explained difference in development?

It might be thought that to answer such questions would be the job of the experimental psychologist. However, in the behaviourist tradition of laboratory psychology, experimental psychologists were trapped into examining learnable 'reactions' and 'skills'. Because they could only hope to account for what looked as if it could be learned, that was all they studied. Nevertheless, because laboratory reactions are contrived to suit experimenters and have little intrinsic motivation or meaning, the behaviourist interest was chiefly in their speed; and this could itself have been promising if any attempt had been made to examine a range of subjects who differed in intelligence. Preliminary evidence for this view had first been pointed out by the well-known behaviourist and personality theorist, Hans Eysenck in a classic paper (1967). Eysenck had escaped to Britain from Hitler's Germany and had become, by the 1960's a leading exponent of empiricism - sceptical, like Binet, of the dogmatism of medical men. Yet although, at London's Maudsley Hospital, he advocated and developed behaviourist techniques to alleviate phobias and unwanted obsessions, he did not follow B.F.Skinner, who scorned talk of traits, dimensions and allied mentalistic abstractions. After Piaget's death in 1980, Eysenck would be the world's best-known living psychologist, though his steady support for the reality of *g* and other deep-seated human differences cost him many honours.*(9)*

By 1980, reaction time (RT) had been studied by differential psychologists (especially by Eysenck's admirer, Arthur Jensen (1987) - see Chapter 1). After subtracting the 'motor time' (MT) component

(i.e. the time taken to respond to the onset of a stimulus - like a single light - when no choice about it is required) from total RT (when choosing which of two lights came on), the remainder, 'decision time' (DT) has a correlation of around -.25 with IQ. RT tasks can be made substantially more complicated by requiring subjects to respond to relatively abstract and complex questions about richer displays: e.g.

'Which of three illuminated lights is, by its spatial separation from the other two, the 'odd man out'?'
or
'Is it true or false of the following display that the letter B is shown above the number 4?'

The IQ/DT correlation may then reach -.50. However, overall the DT correlations with IQ were either modest or seemed just 'common-sense' (when the DT task involved more complex instructions). Thus they could hardly shift mainstream experimental psychologists from their own conviction that RT depends on testees' levels of practice and strategy deployment - which themselves have intrinsically little to do with IQ. Thus human experimental psychologists, despite their long-standing interest in RT's, managed first to miss the non-zero correlation between RT and IQ; and, when it was forced upon them, they dismissed it as yet another modest product of the omnipresent operations of learning. (In fairness, they had plenty of psychometricians for company. For it had long been conventional wisdom that, on IQ tests themselves, the speed with which testees respond to IQ items bears no strong relation to the level of their intelligence (see Carroll, 1993 and Chapter IV). The important speed-advantage of the high-IQ person would prove to be of a different nature.)

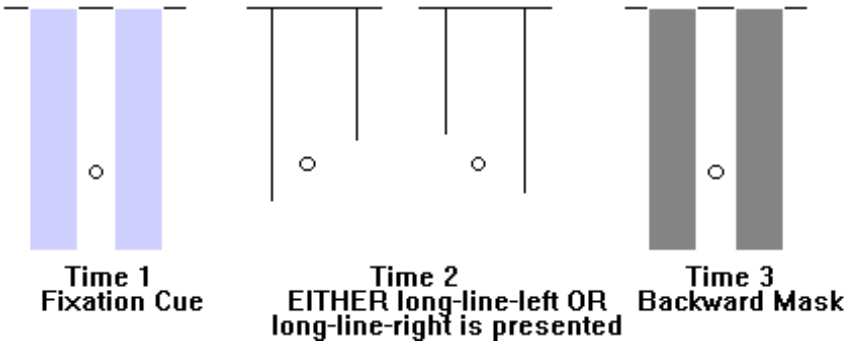
In fact, it was studies of the speed of perceptual intake, not of behavioural output, that would provide the crucial breakthrough needed by the followers of both Spearman and Piaget. Perception had come to be neglected by behaviourists because it seemed so recalcitrantly innate and so uniform as between different people. Yet gradually it emerged that there were subtle yet reliable differences between people in how quickly they could take in, pick up, extract or apprehend consciously the most simple features of the world.

The classic device in the study of perceptual intake speed is the tachistoscope (T-scope), a box in which stimuli can be illuminated for mere fractions of a second to ascertain whether the testee is able to identify them. Importantly, the testee need not be asked to react with speed: the testee's 'perceptual speed' or 'inspection time' (IT) (once called 'sensory RT') - established over a series of trials lasting some twenty minutes - is simply the lowest duration of illumination that the testee requires so as to make largely correct judgments of the target stimuli. Ever since 1908, there had been occasional reports that T-scope abilities correlated with intelligence; but it was only around 1980 that several replicable effects were claimed from work in Adelaide and Edinburgh.

In these IT studies, testees had to indicate whether the longer of two parallel vertical lines (of markedly different lengths, 21/2" or 3") was on the left or right of a central fixation point (see Figure II,3). If they could not verbally distinguish their left from their right, testees simply raised a hand according to the side on which the longer line had appeared. The target lines were illumined for various durations, around one tenth of a second, and then followed immediately by an illumined 'mask' of two overlapping lines (each 31/2"): this prevented any image, 'icon' or after-image of the target lines persisting in immediate visual memory. Across a range of young adult testees, including a few who had a history of mild learning difficulties, correlations between IT and IQ were around -.70 (Nettelbeck & Lally, 1976; Brand, 1979; Brand & Deary, 1982). Detterman (1984) was technically correct to complain that these early studies suffered from "small numbers and extended IQ ranges." However, the effects were very strong, fully significant and involved an IQ range that was only 20% greater than normal: applying Spearman's correction, the true *r* was still .65. No experimental psychologists of this period would have expected these correlations to be other than the modest -.25 found for measures of DT with IQ. The long-sought correlate of intelligence in elementary information processing had possibly been found.

> Figure II,3 illustrates the three successive presentations that have been used most commonly in Inspection Time studies. The three fields of a tachistoscope are illumined in turn. They contain respectively: (Time 1) the fixation cue - often together with 'masking lines; (Time 2) the target lines

(varied randomly from trial to trial as to whether the longer line is on the left or the right); and (Time 3) the backward mask. First, while the testee has been instructed to look at the central fixation point (o), vertical target lines are briefly illumined so as to appear at either side of the fixation point. The testee has been asked in advance to watch for where the longer target line appears - to the left or to the right. The target lines are succeeded immediately by the masking stimulus: this prevents the testee experiencing any after-image of the target lines. With no pressure for speed of response, the testee then makes the required judgment. The experience for the testee is rather as for a batsman who is trying to detect the way in which a ball is leaving the hand of a fast bowler.



Soon, other measures of IT for similarly brief auditory tones and vibrations of the fingers turned out to show strong *r* 's with IQ so long as testees were not mainly university-educated (see Deary, 1992, 1995 for a review). [Other perceptual processes enabling remarkable feats operate quickly, automatically and without awareness (Jaynes, 1974/1992; Velmans, 1991) and doubtless involve such widespread brain activity (both in animals and man) as to be considered anything but 'simple'. However, such operations of 'parallel processing' involve mechanisms adapted by evolution to allow all of us to respond sensibly to the complex but repeated patterns of the real world. By contrast, the perceptual, 'inspection time' tasks described here involve the ability to use not patterned real-world information but highly particular, elementary information that is available only for durations measured in milliseconds. In these perceptual tasks, which expressly require the focussing of attentional resources on answering one elementary question, it turns out that there are important individual differences in what people can grasp.]

What was the explanation of these strong IT/IQ correlations? Could they be explained as causal effects of IQ on IT - as Thorndike had interpreted Spearman's correlation of IQ with attention? Modern cognitive psychology has many ways of disputing the reality of even the most basic and robust phenomena. Perhaps lower-IQ testees were over-anxious at such a challenging task (Irwin, 1984), under-motivated at such a boring task (Mackintosh, 1986), lacking some necessary "elaborated cognitive structure" (Ceci, 1990), unfamiliar with the psychological laboratory, unable to develop the right 'strategies' to assist them, or unable to pay attention and be ready for the onset of the illumination of the target material? Such ingenious attempts at explanation have encountered ten objections, as follows.

1. **Motivation**. Low-IQ subjects enjoy IT-testing. This is because most IT trials use durations of illumination that are set on any one trial to be fairly close to what the testee has managed previously. All testees thus feel they are doing quite well at the task - for they have no idea of what durations (harder or easier) the experimenter is using with other testees. The experience of IT testing thus resembles that of being tested for IQ on an individually administered IQ test such as the Stanford-Binet or the Wechsler. In such testing too, testees are mainly being asked to solve problems that are not too easy and not too difficult for them. Thus the items are not found babyish or boring on the one hand, or too daunting and depressing on the other. At the same time, subjects do not know what items are used to test other testees, so they do not become either over-confident or downcast.

2. **Attention**. Even learning-handicapped subjects cope perfectly well (with 97.5% accuracy) so long as the lines in the T-scope are visible for a fifth of a second. If such testees had any

commonplace problem with attention, this would make such levels of performance quite impossible for them - as Langsford et al. (1994) spell out.

3. **Strategy acquisition**. With only one significant exception [to follow, see (iv)], special tricks or strategies have not been found responsible for testees' achieving high or low IT's. In Edinburgh, Vincent Egan (e.g. 1994a, 1994b) found that giving subjects correct or incorrect feedback on their IT performance made no difference to their IT/IQ correlations: so having the opportunity to learn by results is not necessary to showing the fast intake speed that goes with a higher IQ. Nor was the IT/IQ correlation weakened significantly if testees had to make do without early practise at relatively long exposure-durations: subjects 'thrown in at the deep end' presumably had greatly restricted opportunities for learning or strategy-formation, yet they showed virtually the same IT/IQ *r* . This result has been confirmed in Edinburgh by Deirdre Quinn (1995). Quinn used 28 subjects of mean age 29.2 (s.d. 10.5) and slightly above-average intelligence (Standard Raven' Matrices mean 47.5 (s.d.10.2) - though including some drinking men and women recruited from local bars). When tested in the usual way, with IT exposures gradually becoming shorter (i.e. harder) the IT/IQ correlation was -.52; and when testing began at the hardest durations and gradually became easier the *r* was -.43. It made no significant difference how testing proceeded: higher-IQ testees did not depend on practice effects for their shorter IT's. (For the 14 subjects who experienced the normal, 'slow-to-fast' testing procedure first, the *r* was -.65. - This *r* was found under the most conventional and sensible testing arrangements, and not when maximum opportunity for practice had been given.) Again, the IT's of Egan's normal-IQ testees were unaffected by their having to solve a steady stream of mental arithmetic problems at the same time. This showed that IT requires no special ability to pay 'attention' in any everyday sense of that word. Whereas RT tasks involve sensory and motor processes that may be singularly specialized or open to practice, IT is more 'perceptual' and able for this reason to show higher correlations with IQ (as Jensen (1994) now allows).*(10)*

4. **Movement after-effect**. Some people are able to use an 'apparent movement' cue which they detect as the IT backward mask appears immediately after the target lines. For some testees, the offset (termination) of the target stimulus, followed immediately by the onset of the masking lines, makes the shorter of the two target lines seem to 'jump' downwards for a longer distance than does the longer line. This happens especially if subjects are highly practised or when, for ease of administration, the lines are presented on a computer-driven TV screen rather than in a proper T-scope.*(11)* However, whether a subject 'sees' such apparent movement usually bears no relation to IQ; and there is no known way of training people to watch out for the movement cue (Mackenzie & Cumming, 1986). So the IT/IQ *r* does not reflect differential use of this particular strategy by testees of higher and lower IQ's. IT/IQ *r* 's are thus markedly higher if testees are selected to exclude any users of apparent motion cues. Alternatively, when IT presentation is computerized, different chequered backward masks can be used on each trial (so that the tips of the target lines are sometimes masked and sometimes not): apparent-movement cues are thus rendered virtually unusable and IT/IQ *r* 's return to the same high levels first obtained using T-scope presentation. Thus Stough et al. (1994), having recruited via newspaper advertising in Auckland 35 adults having a mean IQ of 109 and a range that was only 16% restricted (s.d. = 12.6) report a correlation of -.55 between IT duration required and Full Scale Wechsler IQ. The use of a 'flash' mask that provides visual 'noise' around the ends of the target lines after their exposure has similarly countered motion cue use and yielded IT/IQ correlations of -.76 (among testees not using other conscious strategies) (Evans & Nettelbeck, 1993). More generally, omitting the five per cent of subjects who show unreliable performance on IT tasks (for whatever reason) markedly strengthens the IT/IQ correlations: in 63 volunteer testees from unemployment bureaus, having a median IQ of 115, with a range from 80 to 130, Bates & Eysenck (1993a) found that dropping unreliable IT performers improved the IT/IQ *r* from -.45 to -.62.

5. **Individual strategies**. Any one speed-of-intake technique will be of limited interest to conventional cognitive psychologists until they can spot the 'strategy' differences that account for people's varying scores. (Just as behaviourists once attributed all behavioural differences to 'conditioning', so cognitivists invoke 'strategies' - see Brand, 1987a.) Such psychologists

thus profess indifference to IT phenomena despite some sixty studies of IT and IQ in non-retarded young adults finding on average a strong *r* even without using g's full population range. Moreover, since the major reviews by Nettelbeck (1987) and Kranzler & Jensen (1989), a further thirty studies have appeared. Though most recent studies use computerized presentation of lines made up of lights - with their attendant visual after-effects - and an over-representation of undergraduate subjects, correlations seldom dip below .40 (e.g. Deary, 1995); and notions that IT differences might be traced to background features such as exposure to video games or personality type (as mooted by Brebner & Cooper, 1986) have proved unfounded (Mackenzie & Cumming, 1986; Nicolson, 1995). Despite late-middle-aged testees having had so many more years in which to develop the stylistic and strategic idiosyncrasies that would introduce complexity and militate against simple linear correlations between two variables, the IT/IQ *r* is around -.55 (see Nettelbeck & Rabbitt, 1992). Overall, results are compatible with an estimate that the true IT/IQ *r* in the full population (including representative proportions of the young, the elderly and the retarded) would be -.75. Moreover, since correlations around -.50 are regularly achieved across many procedural variations, it must now be reckoned very hard to explain the IT/IQ *r* without referring to general mental speed of intake: after twenty years of research on IT, it is unlikely that any study will now discover key, naturally occurring strategies or short-cuts to success on IT tasks that explain away the IT/IQ correlations.

6. **Intelligent strategies?** Even to suggest that intelligent 'strategies' are required for spotting differences in ultra-briefly presented line-lengths seems bizarre: for how can a person be said to 'do' anything 'intelligently' within one twentieth of a second - or even within the one fifth of a second within which the brain's distinctive processing of the simulus has taken place (see Objection x (c) below)? To import the mentalistic language of plans and strategies to 'explain' individual differences in such automatic processing is strange. (Of course, a person may genuinely 'be' intelligent ('sharp', 'observant') in noticing some briefly occurring phenomenon - but that is precisely the claim of the speed theorist, not the strategy theorist!)

7. **IQ develops IT?** If, over some developmental span, it was IQ that made for subtle psychological changes that eventually yielded better IT performance, then IQ should predict later IT. However, in 104 privately educated 12-14-year-old school children tested over two years, it was earlier IT (auditory) that predicted later IQ rather better (.44) than earlier IQ predicted later IT (.28) (Deary, 1995).

8. **IQ itself the basis for IT?** If IQ just happened to convey some accidental superiority in IT, it would seem unlikely that this effect would be robust across the numerous variations in IT studies over twenty years: virtually no two studies have even attempted to use precisely similar procedures. IQ correlations with auditory IT (for tones that are so briefly presented as to be merely faint clicks) have certainly been lower, around an uncorrected *r* of -.40 (Raz et al., 1983; Brand, 1984; Nettelbeck et al., 1986; Deary, 1994b; Nicolson, 1995); but this is because many testees have pitch discrimination problems (i.e. are somewhat tone deaf) even for tones of normal durations - problems that are unrelated to intelligence. Although only a few estimates are available, visual and auditory IT themselves correlate at around .45 (Nettelbeck et al., 1986; Nicolson, 1995) - as well as can be expected in view of their own imperfections as pure speed measures (e.g. Barrett & Kranzler, 1994): rather than concoct ways in which IQ might convey unlearned advantages on such different tasks, it is more economic to envisage that one underlying variable, mental speed of intake, conveys advantages on IT and *gf* tasks - advantages which crystallize developmentally into differences in knowledge and understanding (gc).

9. **Low correlations?** Variations in the strengths of the IT/IQ correlation are not to hard to understand. Computerized versions of IT have problems because the TV screen cannot display stimuli reliably for very brief durations and because lines made up of lights generate strong after-images. Just as importantly, many studies have used undergraduates who have a markedly restricted range of *g* . Even without testees below IQ 85, the original tachistoscopic method (using a mask composed of multiple lines, and beginning testing with many longer, easier exposure-durations) still delivers an IT/IQ *r* of -.65 (Quinn, op.cit.).

10. **Other tests** of simple information processing functions also correlate strongly with IQ They, too, seem to involve information-intake, or apprehension, rather than the conventionally intelligent operations of reflection, reasoning or problem solving that are the immediate requirements for success at tests of *gf*.

    1. **Information Processing Speed**. One is a task of spotting the lowest number from groups like:

       29 24 30 23 28 26

       This task is trivially easy for even minimally numerate children once the numbers have all been 'taken in' - yet it is this very process of apprehension that takes time and yields marked individual differences between testees: this test (the Information Processing sub-scale of the British Ability Scales) is one of the best measures of *g* all the way through childhood and adolescence (Elliott et al., 1978).

    2. **PASAT**. Another speed-of-intake task is 'paced serial addition' (PASAT). Testees listen to the tester reading out a succession of numbers, at a rate of around one every two seconds. Throughout, after each number is heard, in the gap before the next target number is read out, testees calculate and supply what they think is the sum of the latest two numbers which the experimenter has spoken - as is illustrated in Figure II,4.

       Figure II, 4: PASAT Testing Procedure

       Beginning with slower rates of presentation, testees repeatedly add the last two numbers announced by the Experimenter. Scoring can be in terms of errors, so long as the testee recovers from errors sufficiently to perform correctly on the next few trials; or successive blocks of trials can be used to establish the fastest rate of presentation at which the testee is able to give correct answers on most trials.

Time:	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	→	*etc.*
Numbers announced by Experimenter:			*6*		*8*		*1*		*3*		*5*								*etc.*
Answer to be supplied by Testee:					*14*		*9*		*4*		*8*								*etc.*

       The task can be made harder by decreasing the inter-stimulus gap, and the correlation of PASAT performance with IQ is an impressive .62 (Egan, 1988).

    3. **AEP's**. Recordings of the brain's electrical response to the onset of a single tone have indicated a connection between perceptual intake and intelligence. IQ has often been reported to relate to the waveform patterning of the brain's electrical reaction to stimuli even when subjects are just lying still while tones are played and are not engaged in reporting the tones (or in any other problem-solving work). A hundred trials are usually given so that the part of the 'evoked potential' reaction that is due to the signal is, as it were, magnified in comparison with the part that is due to random noise (which itself, being random, is necessarily changing from trial to trial). The resulting, more reliable 'averaged evoked potentials' (AEP's) are the measures that are finally examined for their correlations with IQ (for a review see Matarazzo, 1992). For example, Gilbert et al. (1991), studying twenty 13-14-year-old children, found the Hendricksons' (e.g. 1982) 'string length' measure of AEP (indexing relatively great variability in the post-stimulus waveform of the potential) to be correlated at .41 with IQ. In large samples from Eysenck's base at the Maudsley Hospital, brain indices yield quite a variety of correlations - up to .45 (Bates & Eysenck, 1993b; Barratt & Eysenck, 1994); and relatively anterior brain locations yield stronger correlations. In Edinburgh, Peter Caryl and Yuxin Zhang have especially remarked the role of the earlier parts of the brain's 'average evoked potential' (AEP) reactions (occurring up to one fifth of a second after

the onset of each tone, especially during the rising phase of the P200 component of brain reaction). Despite their thirty undergraduate subjects' restriction of IQ range, P200 records showed *r* 's as high as .60 with both IT performance and IQ (Caryl, 1994). The London findings indicate that the AEP/IQ relations are to do with post-sensory processing; and the Edinburgh findings locate the IQ-related AEP and IT phenomena at the very earliest stages of perceptual intake of information - prior to brain processes normally associated with cognition, recall or conscious thought.

4. **Letter-reading speed.** A long-running programme of work in Germany has repeatedly yielded clear correlations between IQ and how quickly testees can read (*sotto voce*) through randomized strings of letters of the alphabet (Lehrl & Fischer, 1990). (This is primarily a test of individual differences in intake speed, since the alphabet in its normal, overlearned order can be spoken in half the time and with much less variation between people.)

5. **Infants' responses to novelty**. Tests of how quickly infants get bored with stimuli and stop looking at them (presumably because intake and assimilation are complete) are presently the only substantial individual predictors of IQ in childhood (Bornstein & Sigman, 1986; McCall & Carriger, 1993; Colombo, 1993; Rose & Feldman, 1995*(12)*). Despite the unreliability invariably associated with the psychological testing of infants, *fixation-duration while habituating* predicts 3-year IQ better (r = -.45) than does the rate or pattern of habituation itself. It is distinguishable from usual indices of attention span and exploration; and, though the jury is still out, it "appears to be a measure of speed of processing" (Fagen, 1995). In token of this recognition that such measures are indeed precursors of IQ, newer scales for clinical testing of infant mental development include 'visual habituation', 'discrimination' and 'novelty preference' (Bayley, 1993). Tests of speed of identity recognition have also appeared to have substantial correlations with IQ (Eysenck, 1995). Such developments are entirely in line with the ideas of IT researchers, and equally with IT researchers' predictions that speed-of-intake testing would come to supplement and sometimes replace traditional estimation of *gf* (Brand & Deary, 1982).

There have now been twenty years in which psychological researchers could have found some special explanation for the IT/IQ *r* . Today, to persist with strategy-theorizing in the absence of such serious evidence must be wishful-thinking. Quite the most likely hypothesis at present is that IT tasks manage to tap basic speed-of-apprehension differences; and that these speed differences are causal - both directly, in themselves, and indirectly, over the course of development - to setting up the differences that are finally measured conventionally as the highly correlated variables *gf* and *gc*. All the above lines of research with IT and similar techniques suggest that *g* is essentially connected with 'perceptual intake speed' for elementary information and need no longer be considered merely as 'what the intelligence tests test'. Higher-IQ people are not especially characterized by the speed with which they respond to stimuli, make decisions or execute responses in real life; but they are clearly quicker at extracting the most elementary information from the world. Their intake speed will presumably mean that they can take in more information per unit time and that their final decisions and responses, when they are made, will be of higher quality for being 'better informed'. Although IT tasks themselves are usually less reliable than IQ (especially when computerized) and are correlated better with IQ than with each other, the only obvious ability that they require, in common with *gf*, has to be intake speed. Intake speed need not be at the level of neuronal transmission - though Reed & Jensen (e.g. 1991) have reported evidence linking visual pathway transmission speed very slightly to IQ. It may equally be that superior immediate retention of the earliest traces of a stimulus has the same effect - by allowing good decisions about a stimulus despite a minimal duration of exposure. (In a similar way, Just & Carpenter (1992) outline a theory of individual differences in working memory in which lower *g* is associated with loss of processing that has not been completed sufficiently quickly: e.g. embedded subclauses of sentences may be abandoned at lower *g* levels.) The main point is that *g* is associated with rapid extraction of information - much more than with rapid execution of responses. Yet it is not just Spearman's problem about the fundamental nature of *gf* to which 'intake speed' provides an answer. The biggest headache for

Piagetian theorists, too, may be over. The Piagetian 'constructivist' view of intelligence likens *g* to a toddler's tower of bricks - with later, higher developments depending on earlier ones. This is plausible enough if the growth of *gc* is seen as one feat of childish 'accommodation' and knowledge-acquisition succeeding another. But this notion provides no coverage of three well-established features of *g* .

1. Throughout childhood there are steady improvements even at simple mental tasks - e.g. at short-term memory for telephone-type number strings. Development takes children from an average Wechsler Digit Span of 3.25 (average length successfully recited both forwards and backwards) at age 61/2 to a span of 5.5 by adulthood. The average adult performs this simple task of information processing and temporary storage at a level found only for the top one per cent of 61/2-year-olds (see Carroll, 1993). These marked developmental improvements plainly require no special Piagetian 'accommodatory' or other breakthroughs to any realm of 'higher operations': and, indeed, children improve not suddenly but quite steadily across the age range.

2. In apparent reversal of the 'constructive' Piagetian developments of childhood, old age witnesses a 'deconstruction' that Piagetian theory cannot begin to explain. Though many developmental and lifetime achievements of knowledge and apparent understanding remain unaffected in old age, basic *gf* and capacity for active reasoning (as measured on Piaget's own tasks) declines, especially from about 55. Not only should there be no such deconstruction of intelligence with age, but Piagetian 'interactionism' should actually predict that adults will improve their intellectual functioning right throughout the lifespan. Now, however, help is at hand. For IT's show big improvements through childhood - especially till age 121/2 (Anderson, 1992; Deary et al., 1989); allied measures of recognition time for simple stimuli improve from 44ms to 23ms between 10 years and adulthood (Dempster, 1981); and, out of the entire range of tasks used by psychologists to monitor functioning with every gadget and computer programme of modern cognitive science, it is T-scope performance that shows the biggest deterioration with advancing years (even bigger than the decline of *gf* as conventionally tested). (According to the world's chief authority on the psychology of ageing, Timothy Salthouse (1992, 1993a, 1993b), almost 80% of the age-related variance in some measures of fluid cognition is associated with variations in perceptual speed. Salthouse has written that "statistically controlling perceptual comparison speed greatly attenuated the age-related variance in measures of working memory"; and that "the results of [my own] and other studies indicate that the reductionistic analysis of age differences in cognition can, and should, be extended at least to focus on speed of information processing as an explanatory variable.") Thus the idea of *g* deriving essentially from underlying factors of perceptual and neural efficiency can provide constructivist theorizing about development with the concept transplant that it needs. The child's constructions of intelligence, or at least of knowledge, require, through childhood, an increasing speed-of-apprehension that is essential to raising *gf* and Mental Age; and those Piagetian abilities that are not crystallized into *gc* will be adversely affected by *gf*'s decline.

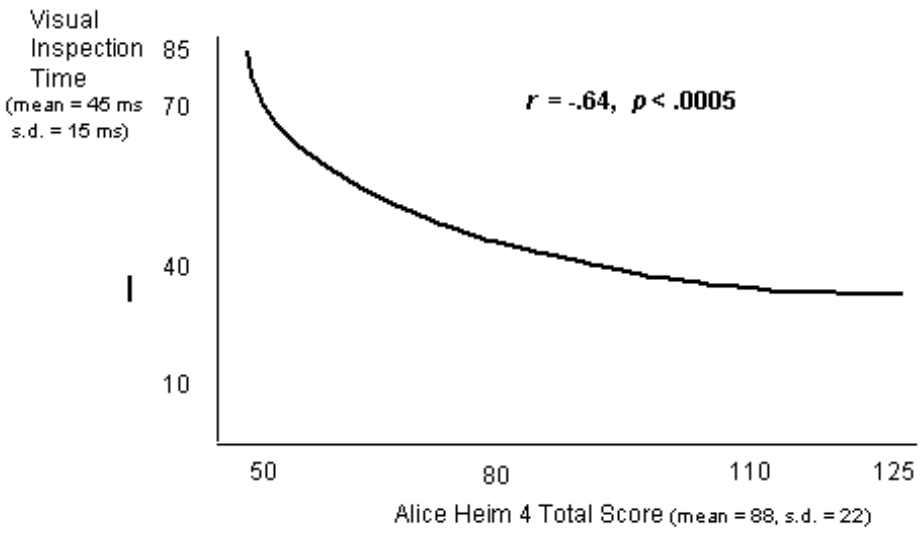
3. Beyond improving on the formulations of Spearman and Piaget, a third advantage of an 'extraction speed' account of *g* differences is to make some room for the latest fashions and findings in experimental psychology. Lately, a key notion for experimentalists has been that of 'working memory', alias short-term memory, or 'desk-top memory', i.e. how well people can take in and hold on to information over a few minutes (normally meaningless information, to maintain scientific purity). By the 1970's, Piagetian tests of 'conservation' (e.g. of the volume of a liquid as it is poured into a differently shaped container) and other candidates for the status of 'new IQ tests' had turned out to correlate quite simply with the old IQ tests. Just so today, 'working memory' has turned out, to the astonishment of experimental and cognitive psychologists, to correlate as highly with *g* as the limited reliabilities and validities of experimentalists' tests of it will allow. The relation is so striking that Kyllonen & Christal (1990) and Salthouse (1993a) have even urged working memory itself to be the source of intelligence differences; however, this cannot explain g's strong relations with IT tasks (which require no working memory in any conventional usage of that term). Indeed, it has actually been known

for some while that doing well at Digit Span is best predicted by how quickly testees can take in the target letters or numbers in the experiment (Dempster, 1981). (How easily people recognize numbers presented for a few milliseconds was found to be quite the most important determinant of whether they could recall numbers over an interval of a minute.) That working memory correlates substantially with most other cognitive tests of the experimental laboratory (e.g. Kyllonen, 1994, p.314) attests to nothing as much as the familiar correlational potency of *g* itself. It can now be appreciated that experimental psychologists have been indirectly concerned with the problem of the nature of intelligence all along, even if they abjured the political incorrectness of relating their work overtly to IQ and psychometric *g* . Piaget's ideas give no reason to link intelligence to experimentalists' working memory any more than to Digit Span or biological ageing; yet these links that have been discovered suggest a fundamental source of those intellectual developments of childhood that Binet and Piaget had noticed.

As intelligence yields key secrets of its nature, one very interesting problem remains. Just as Binet had insisted, and as Spearman himself had actually found, sizeable non-g mental differences are especially seen in people of higher g, MA and IQ (e.g. in the Verbal-Performance distinction and other bipolar contrasts - see Chapter 1). In line with Spearman's idea, researchers have sometimes remarked it to be easier to distinguish independent and sizable differences in literary sensibilities, scientific interests, sporting knowledge, historical curiosity and personality features among older and brighter children (Anastasi, 1970; Brand et al., 1994). Does it help in understanding such phenomena of 'differentiation' if perceptual speed differences are thought to provide the main basis of *g* differences?

Apparently the answer is 'yes'. For the relation between IT and *g* is itself stronger among lower-g testees. This tendency had been observed from the earliest IT/IQ studies in Adelaide and Edinburgh (Brand, 1979); and it is easy to confirm so long as testees range reasonably widely (Knibb, 1992). IT/IQ correlations can easily be as high as .80 for testees around IQ 60 (with s.d. = 15), but they are the usual .50 for young adult subjects of around IQ 110. Furthermore, Levy (1992) has observed that the high IT/IQ *r* 's for lower-IQ testees may be artificially depressed because there is more unreliability of performance found in the records of longer-IT subjects. Some psychologists have proposed that mentally handicapped people, young children and elderly people should not be included in IT/IQ studies because they "spuriously" inflate the IT/IQ *r* 's. But such methodological concern reflects nothing but the egalitarian inclination of many psychologists to ignore g-differences in the population as the major feature of the human condition and to concentrate psychology on university psychology students who are easier to motivate and less disturbing of beliefs in natural equality. Psychology should be about everyone - not about higher-IQ, middle class aspirants who produce pleasing results for cognitivists, disunitarians and closet egalitarians. The proper thing to do is to look at both sides of the coin: that *g* and intake speed have a true correlation of around .75 in the full population; but that, even with efficient methods of IT-testing, the IT/IQ *r* drops to about .55*(13)* when only young adults of normal intelligence are tested, and to around .30 in students having IQ's above about 115 (assuming s.d.'s are similar). Catherine Nicolson's (1995) study of 35 Edinburgh adults (mean age 23, "most....not undergraduates") on a light-emitting-diode IT task (developed by Deary et al., 1989) provides an example (see Figure II,5): Nicolson's overall IT/IQ correlation was -.64, but there was no correlation at all for the subjects in the top half of her IQ distribution, and a correlation of -.80 in across the bottom half of the IQ range.

Figure II,5: Relation between *g* (Alice Heim 4 Test) and Visual IT in 35 young non-student adults (Nicolson, 1995)



It has been a remarkable feature of twenty years' research on IT that so many investigators have used undergraduate subjects and thus missed the clear-cut effects that are obtainable in relation to *g* . In 1946, the distinguished U.S. psychometrician, Quinn McNemar, observed: "the existing science of human behaviour is largely the science of the behaviour of sophomores" (Newstead, 1979, p.384). Sadly, despite today's staggering public outlays on psychology, this is remains true - presumably because it suits most psychologists to keep their heads well and truly in the sand.

Yet even if IT-testing agrees with psychometric testing in finding *g* to be more important to differences among the lower-IQ, and less unitary (i.e. less important in accounting for mental ability variance) amongst higher-IQ testees, how can this be explained? One possibility, first advanced by Ian Deary in Edinburgh (see Brand, 1984), is to point to how intellectual 'investment opportunities' change with *development*. The idea is that, once a person has reached a certain level of intelligence, options present themselves that were not previously available, yet between which choice is necessary (in terms of how time and energy are to be spent). Ingeniously, however, Michael Anderson (1992; and see Brand, 1988) has suggested an alternative focus on *detectability*: this idea is that the relation between intake speed and specific measures of verbal, spatial, logical, creative and memory abilities might be likened to the relation between a tape-recorder and its tapes. Thus, a user's tapes may be genuinely varied in their quality, in uncorrelated ways; but these quality differences between them will hardly be noticed unless the tapes are played on a machine (Anderson's 'Basic Processing Mechanism') that does not itself introduce random noise that makes all the tapes seem of low quality. Anderson's idea is that a good level of mental speed (or 'basic processing efficiency') does not *cause* differentiation of abilities in the higher-g range, but rather allows differences that were always present to be *observed*. At lower levels of speed and g, a testee will not be able to perform well on any mental tasks; whereas, if *g* is high, it can be detected that the subject is better at some types of task than at others.

Deciding between the *development* and *detectability* hypotheses will depend largely on whether differentiation occurs at higher levels of CA as well as IQ: for the *development* hypothesis requires time over which investment and crystallization of *gf* can occur. The largest-ever study of differentiation (drawing data from 10,000 13-16 year old schoolchildren in É ire) reports that mental abilities themselves differentiate according to *g* more than to age and thus favours the *detectability* hypothesis (Deary et al., in press). On the other hand, evidence from past studies is that the *development* hypothesis is required to account for educational attainments and personality features. It seems likely that differentiation of all kinds increases with both *g* and IT; and evaluating whether it increases as a function of time x IT or of IT alone will depend on the age at which IT's own developmental improvement is eventually agreed to stop. Whatever the final story, mental intake speed will join psychometric *g* as a variable that will require close consideration, not neglect, by genuine researchers of personality and individual differences.

Instead of uniting their forces against the vaunted 'mindlessness' and anti-realism of thought-outlawing empiricists and language-worshipping idealists, twentieth-century researchers of intelligence have tended to divide in their pursuit of the different approaches of Spearman or Piaget. Meanwhile, many experimental psychologists and modern cognitive scientists have preferred to try to neglect general intelligence altogether. Today it can be appreciated that the followers of Spearman and Piaget were pursuing largely complementary approaches; and the emergence *gf* as being linked to elementary information-intake solves historical problems that long beset both camps.

General intelligence is no longer just 'what the tests test' - whether the tests be those favoured by Spearman or Piaget. Rather *g* is what develops, enables differentiation and perhaps itself differentiates in the first twenty years of life and beyond. Its fundamental nature as speed-of-intake may itself one day be broken down into sub-components - but these sub-components will be systematically *inter*dependent, not those of cognitive psychologists who are looking to break up *g* into entirely *independent* processes. For *g* itself is a substantially unitary variable that is now known to have strong connections with a wide range of procedures that can be indexing in common only something like the capacity for taking in simple information and registering elementary perceptual features of the world. The arch-critic of all 'reification of factors', Stephen Jay Gould (1981/82, p. 268) has declared his agreement that "under certain circumstances, factors may be regarded as hypothetical causal influences." Today, it is surely time for Gould and supporters to admit that the relevant circumstances have now arisen - or to spell out what further circumstances they would have in mind. Nathan Brody (1992, p.349) has summarized the matter thus:

"The first systematic theory of intelligence presented by Spearman in 1904 is alive and well. At the center of Spearman's paper of 1904 is a belief that links exist between abstract reasoning ability, basic information-processing abilities and academic performance. Contemporary knowledge is congruent with this belief."

Perhaps even Binet himself would not have been too displeased: for at the very outset of his work on intelligence, in 1890 (p.582, transl. J.B.Carroll), he had observed : "What we call intelligence in the narrow sense of the term consists of two chief processes. First, to perceive the external world, and then to reinstate the perceptions in memory, to rework them, and to think about them." Anyhow, with today's advance to 'mental intake speed' in mind, renewed interest attaches to the question of how g-differences arise in terms of the venerable influences of nature, nurture and their interaction with each other. For, whatever biological influences may be at work, some types of ability will surely reflect people's environmental familiarities - especially those familiarities that they have actively cultivated - and thus yield the differentiation of intelligence that Binet had wished to recognize. .

CONCLUSIONS

1. Spearman's view of the generality and importance of general intelligence meant that he was relieved by Binet's practical psychometric achievements and by the clear and strong *g* factors yielded by such mental tests. Spearman was thereafter distracted from his early search for simple, information-processing functions that might underlie intelligence - not least because intelligence itself could have been a partial cause of superior performance on measures of sensory discrimination and attention.

2. Piaget's account of the development of intelligence through childhood allows for children's constructive 'interaction with the environment' in improving their 'schemas' of the world. However, it does not explain abiding individual differences in general intelligence or the decline in fluid intelligence that often occurs in old age. Like Spearman, Piaget left big gaps in his programme and did not attempt to vindicate his belief in the developmental role of nature and maturation by using twin study.

3. Many measures of *speed of intake of information* correlate substantially with IQ - notably Inspection Time (IT). IT is the length of exposure needed by a subject to see target stimuli presented very briefly in a

tachistoscope (or, less satisfactorily, via a TV screen or miniature lights controlled by computer). IT probably correlates at around -.75 with *g* if reliable measures are used and if subjects have the same range of *g* levels as does the normal population (i.e. including the lower levels of *g* that are found in children, the elderly and the mentally handicapped).

4. Such individual differences in intake speed probably play a major roles both in psychological development and in differences in development. Intake speed differences (or processes close and causal to them) either cause *g* differences or are just as affected by *g* as are dimensions of knowledge and reasoning ability. In relation to general intelligence, mental intake speed is either basic to it, integral to it, or both. The *g* factor emerges in a new light from research on IT: it can no longer be identified superficially with reasoning ability or knowledge; and it is no longer just 'what the tests test'.

ENDNOTES to Chapter II

1. Prior to the development of factor analysis proper, Spearman had developed the 'tetrad' method for seeing whether a matrix of correlations contained more than the *g* factor. He would calculate the product of any two correlations, rab and rcd; from it he would subtract the product of the other available correlations, rac and rbd. If, over repeated (and indeed laborious) calculations, any such product differences were non-zero, he would conclude that more factors than just *g* would be needed to account for the whole pattern of intercorrelations in the matrix. For example, if tests a and b are especially highly correlated because they both reflect (say) clerical ability as well as g, then the above exercise will yield a non-zero outcome.

2. To handle negative correlations, all correlations in the matrix may be squared; or one of the variables may be 'reflected' (e.g. extraversion can be renamed as introversion).

3. Evans and Waites (1981, p.129)) hope that Thomson's (1916) interpretation of mental tests' intercorrelations can stand even when they admit Louis Thurstone's idea of several distinct abilities to have fallen. However, they make the same prediction from Thomson's theory: "If this picture is correct then it should, in principle, be possible to devise a series of cognitive tests each of which taps distinct cognitive systems, and which yield scores which are not mutually intercorrelated." Evans & Waites further cite the work of Stevenson et al. (1976) as having the promise that they seek; but still, today, there is no battery of the requisite uncorrelated mental tests to have resulted from this work - any more than from J.P.Guilford's or Howard Gardner's programmes (see Chapter I).) The noted behaviourist and psychometrician, Lloyd Humphreys (1971, 1994) maintains a similar view, that intelligence is 'the acquired repertoire of information, knowledge, and intelliectual skills available to a person at a particular point in time: but from a 'repertoire' it really should be possible to sample plenty of routines without sampling others.

4. Like Binet, Spearman took the view that Binet's programme of multiple tests had succeeded because errors in one form of assessment were roughly cancelled out by the errors made by the others. Spearman held that IQ probably correlated as high as .90 with *g* . However, Spearman was concerned to identify the nature of *g* more closely if possible.

5. Prior to the big expansion of university education in the 1960's, IQ levels of students were probably around 140 - as would be expected from the students being highly selected (as within the top 1% of the population in terms of academic achievement) and IQ correlating at .50 with educational attainment. Herrnstein & Murray (1994) consider that American universities may have become progressively more selective by IQ-type criteria throughout the twentieth century, but there is no direct evidence for this proposition.

6. It is also tends to be forgotten that Thurstone himself had no objection at all to using factor analysis to seek the structure of biological reality: he believed his own preferred 7 factors (at first hypothesized to be independent) were indeed more real than *g* and just as heritable (e.g. Brand, 1984; Gould, 1981).

7. The declared opponent of unconditional reification, S.J.Gould (1981/1992, p.309) correctly observes: "The very fact that estimates for the number of primary abilities have ranged from Thurstone's 7 or so to Guilford's 120 or more indicates that vectors of the mind may be figments of the mind."

8. Kuhn's .80 correlation involved middle class 7-year olds of around IQ 109. Her *r* 's were lower (.33 after unreliability correction) for middle-class 11-year-olds of around IQ 114 - a result indicative of differentiation of abilities at higher *g* levels (see the last Sections of Chapters I and II).

9. Although Eysenck became Britain's best-known psychologist by the 1970's - and behind only Freud and Piaget in international indices of how often work is cited in learned journals - he was not knighted. Eysenck had especially upset the British establishment in the 1950's by being one of the first to suggest that Fascists and Communists might have something psychologically in common (Eysenck, 1954). His autobiography, Rebel with a Cause (Eysenck, 1990) documents his many

anti-establishment involvements.

10. IT may show changes over such exposures as the 38,400 trials given to two subjects over 60 days by Deary et al., 1993; but this is of little relevance to explaining IT differences as ordinarily tested.

11. Since a TV screen is 'refreshed' only at 25 milliscecond intervals, scheduled exposure durations are seldom achieved. Precise computer-controlled durations of illumination are enabled by light-emitting diodes; but these produce much stronger after-images and apparent movement effects than do T-scope presentations. Modern technology is much better at mimicking processes of decision-making and output than at mimicking real-world input - this is probably the secret of why 'artificial intelligence' remains a pipe dream.

12. Rose & Feldman (1995) found correlations by age 11 of around .30 for 167 children tested as infants with measures of visual recognition memory. They note that "most of the infancy measures were related to perceptual speed." Such a degree of forward prediction of child IQ, across ten formative years, is usually exceeded only by using the IQ's of children's parents.

13. Correlations of -.35 typically found in student subjects correct into estimated correlations of -.55 for the full, normal range of IQ's in young adults - e.g. Deary et al., 1989.

III NATURE IN NURTURE - *the developmental origins of g differences*

- *Positions and phobias*
- *Eugenics, Sir Cyril Burt. and Leon Kamin*
- *Obstacles and objections to psychogenetic research*
- *Seven major research programmes, eight new findings*
- *Heritability estimates - why all the fuss?*

OUTLINE

How do individual differences in intelligence come about? - For example, why is there (on average) a difference of 12 IQ points between ordinary children who grow up in the same biological family? Perhaps researchers will never find out. Perhaps it is a 'meaningless question'. And perhaps that is a very good thing.

This chapter concerns the legendary 'nature-nurture controversy' about general intelligence. This long-running debate - or, sometimes, non-debate - has been beset by:

1. (a) anxieties about the social and political implications that might seem to follow if *g* differences were thought largely genetic;
2. (b) accusations of fraud against the leading mid-twentieth-century exponent of a largely 'hereditarian' account of the *g* factor;
3. (c) protests that psychogenetic research is anyhow pointless. For these reasons geneticists have fought shy of studying *g* ; and most psychologists have preferred their homely offices and high-IQ subjects to the real-life study of twins and adoptees.

Anxieties about possible state interference in family life are considered in the context of interventions that are made already, of future possibilities of genetic engineering, and of the improving aspirations of social environmentalists. The question of fraud by researchers is serious - not least when it results in criminal conviction and imprisonment; but science has its own answers to fraud so long as enquiry is allowed to flourish. Methodological problems about nature-nurture questions are probably the most grievous for science, so they are examined. The chief concern is with the popular suggestion that nature and nurture are so complex in their 'ongoing interaction' as necessarily to defy the scientist.

The past decade has brought new researches from the USA, France and Finland. These allow estimates of the importance of the parentally supplied environment, of the 'micro-environments' that children choose for themselves, of genetic influences (some of them heritable), and of such 'interaction effects' as can be specified by would-be devotees. Ideological resistance to psychogenetic research has always been a matter for shame and is now pointless. Today it is increasingly clear that the truth about *g* 's degree of heritability must be sought, not shunned. Modern research into other human psychological differences suggests that no alterations at all of heredity or environment would have much effect on average trait levels in the population: *g* itself might be similar. Learning the truth is now easier than obscurantist endeavour - not least because discouraging irresponsible parenthood is anyhow a natural objective for theorists of both hereditarian and environmentalist persuasions.

There have always been psychologists who disagreed with Spearman and his intellectual descendants in the London School. Many of today's psychologists view with alarm the possibilities that intelligence is either substantially *unitary* or closely associated with *speed of intake* of elementary information. For many psychologists, it has been a cardinal principle to dispute (if they could not ignore) both the 'positive manifold' of mental test correlations that licenses talk of *g* (see Chapter 1) and the association of general intelligence (*g*) with 'inspection time' (IT) (see Chapter 2). Such leading American educational psychologists as Howard Gardner and Robert Sternberg continue to cavil at the London School claim for the centrality and underlying simplicity of *g* .

However, though he is the best-known student of Louis Thurstone, the original disunitarian, John Carroll (1993) has concluded that *g* differences create correlations between hundreds of mental tests in hundreds of studies (see Chapter 1); and the British experimental psychologist, Patrick Rabbitt, has acknowledged a strong link between *g* and Inspection Time (Nettelbeck & Rabbitt, 1992) (see Chapter 2). Despite objections and fixed ideas, research on test inter-correlations and basic processes has at least continued; and today there is probably increasing agreement on the importance of *g* differences across lower ability levels and on the 'differentiation' of the more varied ability and personality profiles of higher-g people (e.g. Brand *et al*., 1994). It was only on another type of question, about the *developmental origins* of *g* differences, that twentieth-century psychologists would quite largely abjure their usual principle that 'further research is necessary' - at least so long as the taxpayer foots the bill.

This question, about *g* 's heritability, concerns the respective involvement of three broad influences: genetic (G) differences, environmental (E) differences, and more or less complex 'interactions' and 'covariation' of *g* and *E* variables (especially 'G x *E* ' and 'G,Ecov') are the main ways in which people's *g* differences might be produced. These three broad types of influence bear comparison with those that have appealed respectively to people of differing philosophical persuasions.

1. (i) *Rationalists* (who find key truths 'self-evident' to human reason) and hereditarians put more stress on 'hard-wired' human faculties and individual differences and on the fundamental abilities (or inabilities) that result: they incline to accept genetic provision of abilities.
2. (ii) *Empiricists* stress the role of the environment and of our conditioning (or other similarly passive experience): they presume experience is the prime contibutor to our kowledge and to our natures.

3. (iii) *Idealists* prefer to invoke more active, on-going constructions that usually involve language and society and often a semblance of a person (of unspecified genetic ancestry, but still available to do all the necessary perceiving and interacting).

Given the relatively distinct nature of the three options, an important stratagem for any one party to the argument is to dismiss the other two options as old-fashioned or simple-minded: if any two of the theoretical sources of human variation cannot deliver, then the remaining option has a field day. Importantly, preventing new research can be a useful tactic in this process.

Sensitivity about nature / nurture enquiries is very proper. Before the Nazi period, there had been optimism among progressive people that genetically based features of humanity could be steadily improved - even if not transformed overnight, as the discredited doctrines of Jean Lamarck (1744-1829) had once promised. Britain's leading Liberal, Asquith (later Prime Minister), spoke for many when he asked "What is the use of an Empire if it does not breed and maintain in the truest sense of the word an Imperial race?" (Webb, 1901).*(1)* Eugenics (selective procreation)*(2)* offered one answer to the growing urban squalor of turn-of-the-century Europe. (Prohibition of alcohol seemed the obvious alternative for impoving the human condition without vastly increasing the burden of debt on future generations; but the USA would try even this drastic measure without success.) Thus Ronald Fisher (1890-1962), the British statistician and pioneer of the science of population genetics declared (1913/14): "Darwinism is not content to reveal the possible, perhaps the necessary destiny of our race; in this case the method is as clear as the detail; the best are to become better by survival." To Fisher, as to Galton, genetic factors contributed at once to the individualism, the hierarchy and the successful functioning of human society; and they pointed the way to improvement, if desired. In the 1930's, Aldous Huxley, who had memorably satirized statist utopianism in his *Brave New World* (Huxley, 1932), embraced eugenics as the long-term answer to rising unemployment;*(3)* and the Marxist geneticist, J.B.S.Haldane (1938), was another of many to see eugenic policies as useful in counteracting what, in the aftermath of the attrition of talent in World War I, was feared to be a declining level of national intelligence. Such ideas were to have wide popularity and lasting impact: compulsory sterilization of supposedly mentally defective girls was still being practised in Virginia as late as 1972. After 1945, however, among the intelligentsia, to deem a characteristic 'genetic' seemed relatively pessimistic: for by then the drawbacks of eugenics were becoming clear, as follows.

1. (i) Because of such complexities as recessive genes, which could transmit characteristics invisibly across generations, enouraging responsible parenthood might take a long time to have any effect on national levels of psychopathology and mental retardation.

2. (ii) It is not clear how to motivate people decisively towards eugenic parenting when welfare states shoulder much of the financial responsibility for medical and educational casualties. (Not even munificence is required to support welfare states:

present-day voters provide the funds chiefly on the assumption that they and their children will be well looked after in their turn.)

3. (iii) Today, 'reform eugenics' (e.g. Kevles, 1985; Paintin, 1995) involves only voluntaristic measures that involve no state inducements: its procedures are those of carrier detection, eugenic counselling, control of environmental mutagens, preimplantation diagnosis of inherited abnormality, legal (and, in Britain, state-funded) abortion, the provision of opportunities for women themselves (or, in Britain, their medical advisers) to select suitable sperm donors, and ova transplants. Even so, eugenics necessarily involves some people realizing that their own attributes and tendencies are effectively being deselected by others - whether the disfavoured conditions are thalassemia, cystic fibrosis, Duchenne muscular dystrophy, adenosine deaminese deficiency, Lesch-Nyhan syndrome, premature baldness or short-sightedness. At present the wishes of non-Western women for fewer daughters and more sons are held in check by the expense of artificial insemination - otherwise, paralleling debates about abortion, there would already be a second controversy about 'a woman's right to choose.'

4. (iv) However tactfully, sensibly and voluntarily eugenic measures are introduced, there is always the possibility of the 'improvers' becoming impatient with human rights and instead pursuing compulsory eugenics - notably, compulsory sterilisation. India's campaign of mass vasectomy in the 1970's provided men with the inducement of free transistor radios but it was widely experienced as involving social pressures bordering on the compulsory. Indeed, beyond programmes of sterilisation, the exterminative programmes of state-enforced euthanasia and the Holocaust had soon turned out to be preferred in Nazi Germany by quite a few of the politicans and experts who had at first seemed to advocate only eugenics; and apparent eugenic concern for human improvement had given way to racial triumphalism and the arbitrary suppression of minorities.*(4)* Doctors may today practise euthanasia in Holland (when three doctors agree with persistent requests from a patient or, if the patient is unable to act, from relatives); but anxieties about 'undue pressure' being put on patients will always arise so long as it is relatives or the state that must foot the bill when a very sick patient prefers to postpone death with the help of doctors or surgeons.

Today, when millions of people have been the victims of genocide in Cambodia, ex-Yugoslavia and Rwanda-Burundi, and when millions of aborted human foetuses are incinerated annually in the West, anxieties about any possible 'slippery slope' from voluntary eugenics to involuntary death camps have to be balanced by a proper concern for all-round reduction of present and anticipatable horrors. Scientific, social and political changes may have lately made eugenic options relatively more acceptable. Seven developments are especially relevant.

1. (i) Human genetics is on the brink of offering gene replacement therapy just like any other medicine to help the unhealthy themselves and not just their descendants. Already the severity of the consequences of some adverse genetic mutations is moderated, in individuals, by the somatic introduction of unmutated genes (Postgate, 1995).

2. (ii) It seems clear that some gene therapies will involve alterations to the sex cells, and thus to the 'germ line' - allowing changes to be passed on naturally to patients' offspring. Advisers to the European Commission have apparently suggested that germ-line therapy that made changes in people's DNA would be "foolish and irresponsible."*(5)* However, according to a report in *Nature* (Butler,1994) a UNESCO International Bioethics Committee working group says that "debates about germline gene therapy and 'directed evolution' amount to much ado about nothing. The only application envisaged, namely to spare descendants a serious disease, could ultimately be achieved more cheaply by sorting sperm or by selecting embryos, as is already done in several countries."

3. (iii) As is indicated in the foregoing observation, eugenics is already practised clinically in modern medicine. (This is why the UNESCO Committee maintains that gene therapy will only be an extension of exisiting prophylactic practice.)

4. (iv) There is now wide acceptance of nation-states spending around a quarter of their citizens' gross national products on their behalf, via taxation, with the intention of improving population levels of health, educational attainment and employability.

5. (v) There is greater realization of the extent to which ordinary parents who have handicapped children limit distribution of attention and affection to such children quite unconsciously: even though parents may insist verbally that they treat all their children equally, careful observation shows that they make decisive choices about when to lavish more nursing care and when to restrict further investment of time and effort in an unpromising child (Mann, 1992).

6. (vi) Any who have genuine anxieties about counterproductive and dangerously escalating state intervention and spending can today support libertarian campaigns to privatize welfare into state-aided private insurance schemes.*(6)* (Even beyond private insurance for health and medical costs, it could be arranged that criminals paid the full costs of their crimes from insurance - including the recompense of victims.*(7)*)

7. (vii) It is possible to articulate a coherent and workable code of eugenic practice in which respect for human autonomy and reasoning are unreservedly respected as the sources of all specifically human activity (Bayertz, 1995). Instead of relying on ancient rules or impossible calculations of future gains from eugenic interference, Bayertz''s 'GenEthics' provides a locus of value in human intelligence.

Nevertheless, these six developments are modern novelties. Immediately after 1945, people were bound to ask what was the point of research which might sometimes result in our knowing that important human differences are partly genetic. Were hereditarianism, eugenics, elitism, racism, ignorance, paranoia and barbarism not fatally intertwined and incarnated in Hitler's Reich?*(8)* What was the point of trying to disentangle them? Who could wish to sort wheat from so much chaff?

In this regard, the British psychologist, Cyril Burt (1883-1971) was a singularly re-assuring figure. After studying in Oxford with the Lancastrian instinct psychologist and forerunner of

sociobiology, William McDougall*(9)*, yet also liaising with the cognitively oriented Spearman, Burt first lived and worked for five years with delinquent boys in the University Settlement serving Liverpool docklands. Alert to issues of what could be proved by measurement, he particularly noticed that Binet's tests pointed away from authoritarian traditions of the past and towards the understanding of individuals. Burt's next appointment, in 1913, as the first-ever educational psychologist for London County Council, extended his contact with children and led to what was to be his most popular book, *The Young Delinquent.* Here Burt advocated social and environmental improvements, welfare spending and expanded employment of educational psychologists - especially since "the problem never lies in the 'problem child' alone: it lies always in the relations between that child and his environment" (Burt, 1940, p.243). Burt also urged the use of intelligence tests - while recognizing other ability factors (especially beyond MA 11) and being aware that *g* might possibly reflect only "the irrepressible disposition of the human mind to reify" or a too simple reduction of *g* "to single atomlike existents" (Burt, 1940, pp. 66, 237).*(10)* From the time of IQ tests' first official use in Britain (by Bradford's progressive (Labour-controlled) education authority, to award free grammar school places (Burt, 1924)), Burt's ideas enjoyed steadily increasing official acceptance. Notably, in 1938, British government committees accepted Burt's evidence that the increasing range of mental differences with age through childhood required separate teaching for children of different abilities, at least by age twelve (Evans & Waites, 1981, p.93).

Representative of British rejection*(11)* of compulsory sterilization, ethnic segregation and euthanasia, Burt was no sympathiser with Nazi Germany. More than Galton and Spearman, Burt was 'politically correct' about racial differences in intelligence: in 1923 he told the British Association that any "innate group differences" were small in comparison to the variation that was found between individuals (Blinkhorn, 1994). For a man of his age, he played a full part in the 1939-1945 British war effort, and he was knighted for his advisory work in education and propaganda by the post-War Labour Government. As interested in parapsychology as in the dispiriting question of whether national IQ might be falling, Burt became best known for the educational revolution that he enabled.*(12)* Whereas primary school teachers understandably prefer polite middle class children who are interested in their lessons, Burt advocated that all bright children, regardless of their backgrounds and records in primary school, should have free access to a fully academic, grammar school education. This proposal had the merits of economizing in the distribution of resources, individualizing education according to a sensible principle, and seeking maximum 'value added' attainment for all children. Thus it was popular in its day and was implemented by most UK Local Education Authorities in Britain soon after the War.*(13)*

Burt was a hereditarian about intelligence; but he believed that improving the match between educational goals and IQ levels would prove beneficial to the life-chances of *all* children. For an academic, his achievement was remarkable - even though, from the beginning, local educational authorities showed little interest in setting up the technical schools that Burt had wanted (alongside grammar schools) for children of greater practical that verbal abilities. (By contrast, West Germany followed Burt's recommendations - see Chapter IV.) More problematic, middle-class parents would become resentful when their own children not infrequently 'failed' the 11+ examination, with its new-fangled IQ component, while some local children passed despite a poor record of attendance, behaviour and achievement at primary school. Some L.E.A.'s (e.g. Hertfordshire, in 1954) reacted to mounting pressures from the expectant middle classes by abandoning the IQ

part of the 11+ examination and relying on conventional examinations and teachers' assessments. However, this reduced the percentage of working class children going on to grammar school (Floud & Halsey, 1957). Now even harder to defend, selection itself was progressively abandoned: by 1980, the vast majority of state secondary schools in Britain were 'comprehensive'. Nevertheless, Burt's memorial is that increase through the 1950's of candidates from modest social backgrounds who finally met traditional university entrance requirements in competition with children who had enjoyed the privilege of private education; and Burt's achievement would have been still greater had his proposals been followed in full. Today's universities may take in many more undergraduates than was ever envisaged in Burt's day; but such education is no longer a guarantee of a tenured post in the Church or Civil Service - or anywhere else.*(14)*

Burt's achievement was to realize the full potential of brighter children. Unlike later educational gurus, Burt's revolution did not simply lower the system's standards to disguise underachievement. Most notably, Burt's *protégés* included girls, whose unsuitability for academic learning was taken for granted until the arrival of IQ testing. While Galton had thought his Science Museum data showed women were "on all counts inferior to men" (Beloff, 1973), Burt & Moore (1912) had arrived at what would prove at once the most revolutionary and the best agreed conclusion of twentieth-century psychology: "with few exceptions, innate sex differences of mental constitution are astonishingly small - far smaller than common belief and common practice would lead us to expect."

After 1950, in retirement from what had once been Spearman's Chair of Psychology at University College London, Burt was to see the most central of his considered views come under increasing challenge as the fashion of academic psychology favoured environmentalism and the multifactorialism of Thurstone and Guilford. Burt (1955) was especially unhappy with the idea that "the examination at 11 plus can best be run on the principle of the caucus-race in Wonderland, where everybody wins and each get some kind of prize." Remarkably, in 1955, and again, eleven years later, at age 83, Burt (1966) wrote papers claiming that, with the help of female assistants and colleagues, he had, since 1940, been able to amass psychometric data on some rare and theoretically crucial subjects. He had studied a growing number of pairs of identical twins who had been separated early in life: by 1966 he was able to report on 53 pairs of 'monozygotic apart twins' (*MZa*'s). Apparently, Burt's *MZa* twins were correlated very strongly for IQ: their within-pair, 'intraclass' r (.771) for IQ was almost as high as were their r's for height and weight; and the twins differed little more from each other in *g* than do individual testees differ from themselves on a 20-minute test when re-tested over six months. With the help of adjustments "to reduce the disturbing effects of the environment to relatively slight proportions", the *MZa*'s correlated almost as highly as the reliability of IQ testing allowed. Whatever educationists of the 1960's preferred to do, Burt was confirming the rationale of the educational revolution which he had urged: deep-seated intelligence differences could not be neglected by educators without a price being paid by children themselves .

Shortly before Burt's death, the scholarly American behaviourist and former Communist, Leon Kamin , returned to the USA from the refuge he had found in Canada during the McCarthy years. Himself an international expert on the conditioning of the laboratory rat, he was intrigued by the persistence of Burt's influence in psychology - not least on his fellow learning theorist, Richard Herrnstein (see Chapter IV), who had defended London

School views in *The Atlantic Monthly*. To find out where the truth lay, Kamin began to examine Burt's papers. Fortunately he was something of a number-lover. Like James Shields, the London researcher who had conducted the biggest study of *MZa*'s and had himself discounted Burt's earlier work (Shields,1962), Kamin soon discovered many flaws - to be detailed in *The Science and Politics of IQ*. Anticipating Kamin's (1974) book, London School insiders admitted that Burt's 'classic' twin study would have to be discounted for scientific purposes (Jensen, 1974). A closer reading of his work than Burt had received during his lifetime*(15)* had revealed it was far from clear who his *MZ* twins were; or where and how or by whom they had been tested. Still worse, some of Burt's results were most unlikely - notably the constancy of his *MZa* correlation which stayed the same, at .771, over the years, despite Burt claiming to have tripled the number of pairs in his *MZa* sample between 1943 and 1966. Thus the best known British psychologist of his day was posthumously denounced for fraud by the British Psychological Society in 1979;*(16)* and the 'hereditarian'*(17)* cause about IQ and *g* that Burt had espoused suffered a corresponding setback. Subsequently, two books appeared (Joynson, 1989; Fletcher, 1991) urging that the correct verdict should have been 'not proven' or even 'innocent' (for reviews see Brand, 1990, and Aldhous, 1992). The basic problem was to explain how a gifted methodologist like Burt, if he had really intended outright deception, had not been able to make a better job of it. However, most psychologists remained impressed that Burt had been at least a brazen rogue even if he was not a devious fraud. In understandable hubris, his opponents would claim him to have been a reactionary, an elitist and a racist. Such labels provide no fit to Burt's involvements or pronouncements of a lifetime; but the penalty for bold claims from slipshod science is rightly a heavy one in a world where truth-claims are largely adjudicated by scientists. So, by 1974, the hereditarian cause about IQ differences had a new, high hurdle to clear.

Although there were plenty of other studies of twins, and even of *MZa* twins, in the scientific record, only Burt's *MZa*'s met the important methodological criterion of having been reared in uncorrelated homes. Burt's *MZa*'s had apparently been raised in homes that differed (on average) as much as homes throughout the entire population differ (on average) in levels of affluence and social class (socio-economic status (SES)). Thus, for a short while, Burt's figures ruled out the most familiar explanation usually offered for *MZa* similiarities by social-environmentalists - that the twins have been brought up in similar home environments. By 1980, other types of study, too, needed re-doing. The crucial correlation of .25 between the IQ's of unrelated adopted children growing up together suggested at least some influence of family environment on intelligence; yet, like many twins reared apart, adoptees may have been somewhat 'selectively placed' (by adoption agencies) with parents who were thought similar to adoptees' biological parents.*(18)*

However, by 1980, the interest in psychogenetic studies was limited - at least in Britain. Professional geneticists preferred to progress towards quite specific gene therapies for rare and manifestly undesirable conditions, and to avoid controversial topics; and Burt's psychological critics wanted to close the account with the chapter on Burt. Indeed, many were coming to deny the very possibility of doing any useful work on heritability. Their rallying proposition was essentially: 'Intelligence is the result of an interaction between

nature and nurture so complex as to be (mercifully) impossible to untangle in any meaningful way - any more than eggs can be unscrambled'. Even today, according to Hirsch (1991) and Wahlsten (1990), development is considered so complicated and *g* x *E* interactions so abundant that no estimates can ever be made of the relative contribution of genetic and environmental factors. Similarly, Lewontin (1992) and Lerner (1992) call for recognition of what is apparently Karl Marx's idea that organism and environment are so completely "fused" that it would be meaningless to think of disentangling them. After the Burt *débacle*, uninhibited delight in complexity came to be offered as a substitute for finding the truth.

In fact, behind this smokescreen of 'interactionism' there can usually be found one of four quite different broad claims. Properly considered, none of these claims, diminishes the interest and value of twin and adoption studies.

1. **Inseparability**. It is often said that everyone has 'both genes and an environment'; that development must be a product of both - rather as the area of a field depends upon both its length and breadth; and that genes and environment are thus inseparable in their 'complex interaction'. However, this popular claim itself turns out, on consideration, to mean any of four quite different things - all of them trivial, routine or wrong.

    1. *Human differences are typically affected by both genetic and environmental differences*. This claim is plainly true, but it cannot be proved to be so except by population-genetic studies. Anyhow, both is too small a word to cover the range of possibilities: to plan further welfare endeavours, for example, it is plainly important to have an informed view as to whether genetic factors account for 75% or for 25% of existing observable ('phenotypic'*(19)*) variance in the general population.

    2. *Development occurs, as envisaged by Piaget, in a series of ongoing interactions, i.e. interchanges with the environment*. This claim concerns the intra-individual development of all children, not the inter-individual differences between children. Its correctness - or, more commonly, incorrectness (see Chapter II) - is quite independent of how phenotypic differences come about: all children might learn (or remain ignorant) from asking questions of their parents, yet they might all make such similar gains as to remain equal to each other in understanding. Psychogeneticists cannot be criticized for neglecting interaction unless the hypothesized interaction is advanced as relevant to explaining eventual phenotypic differences.

    3. *Genetic and environmental factors sometimes have their effects multiplicatively (in calculable statistical interaction with each other)*. This would happen, for example, if a child's musical skills in adolescence had depended on the child's having both a few 'genes for music' (and for persisting with music practice) and on its having had parents who provided encouragement and paid for tuition. It is what psychogeneticists themselves

mean by *g* x *E* ; and there is a clear criterion for its occurrence. If similar genes and certain similar environments are both necessary, in combination, for a particular phenotypic similarity to occur, the similarity of *MZ* twins reared together (MZt's) should significantly exceed what would be expected merely from summing the similarities of *MZa*'s and of unrelated adoptees reared together. Again, in adoption studies, a *g* x *E* effect could be detected if adoptees achieve a certain phenotypic level (e.g. college entrance) only when particular features (e.g. having been to college) are present in both the biological and the adoptive parents. (It has sometimes been thought that environmental features are particularly important to higher-IQ children - i.e. that their educational outcomes especially involve a *g* x *E* multiplication effect. A multiplicative influence of a high IQ was thought by Burt to require a more demanding educational exposure for bright children: in particular, it explained the very high results in educational attainment and real-life achievements that accrue when an adequate educational input is supplied to such children (Burt, 1943). Today, such results are sometimes claimed in studies of gifted children - see Chapter IV.)

4. *G and E differences sometimes 'covary' during development*. That is: the genetic and environmental levels that are operative may themselves be correlated - such covariation being symbolized as *G*, *Ecov* . Such *G*, *Ecov* creates more final phenotypic variance in the population than would have arisen if the relevant *g* and *E* influences had been independent of each other. Examples of *G*, *Ecov* would be: if children with 'genes for violining skill' tend also to be born into homes where the parents are musical and will particularly encourage the children to persist with violin practice; or if parents notice that their child seems to appreciate music, and then respond to this by supplying suitable instruction - though they would not have done so just for any child of theirs; or if the child, being musical, enjoys music, welcomes music lessons and seeks its own violin for a birthday present - thus changing its own environment (or microenvironment, or milieu), which now comes to include the child's own violin. It is harder to detect all possible forms of *G*, *Ecov* , though the more interesting, 'active' forms should yield relatively high r's for *MZa* twins (versus DZt's). (*MZa*'s will tend to make their originally different environments similar in relevant ways, whereas the *DZ* 's, being on average only 50% genetically similar, will push their initially similar supplied environments apart in so far as active *G*, *Ecov* occurs). Like *g* x *E* interaction, and contrary to what some devotees of it may like to imply, *G*, *Ecov* cannot have any effect without there being substantial 'main' effects of both *g* and *E* . Moreover, active *G*, *Ecov* is not some novel type of effect with which to amaze hereditarians; rather, it is just one of the routes by which hereditarian theorists have always supposed genes to yield final phenotypic differences. Genes can (however indirectly) guide people to select and create particular micro-environments for themselves which, once created (whether in the form of 'noisy friends' or 'a collection of tapes about Zen Buddhism') will have their own causal effects back upon them. Such 'active *G*,E COV ' deserves its own title of 'transaction' in so far as people's own 'nature' comes to influence their 'nurture' - a process for which modern psychogenetic work offers hard evidence (see Scarr, 1992; Plomin *et al*.,1994; and see below).

More generally, regarding the 'analogy' with areas of fields beloved of professing interactionists, it is in fact perfectly possible to distinguish between rectangles in terms of their linearity versus squatness; and to attribute size differences amongst any set of rectangles to their differences in (1) height, (2) width or (3) the multiplicative interaction of height and width with each other. All rectangles 'necessarily have heights and widths'; but they need not, of course, have the same heights and widths. Any number of rectangles can differ among themselves chiefly in height, breadth or in both aspects; likewise, phenotypic differences can arise because of *G*, because of *E* , or because of both types of differences in ('interactive') multiplication with each other.*(20)*

2. **Specificity**. Plant and animal geneticists sometimes say that heritability estimates are 'essentially meaningless' because they can only be made for particular populations under particular conditions. Especially, a genetic effect will often work via an 'epigenetic route' that depends on environmental factors taking certain particular values. Each genotype may thus have its own 'reaction range' of environments: for some genotypes, how well they fare will depend markedly on the environment in which they are placed, whereas other genotypes will have a smaller range of reactions (Gottesman, 1963) (see Figure).

   Across a sufficiently wide range of genotypes and environments, it may happen that "the contribution of nature is a function of nurture and the contribution of nurture is a function of nature, the one varying in dependence on the other, so that a statement that might be true in one context of environment and upbringing might not necessarily be true in another" (Medawar, 1977). Thus, if all possible environments are considered, "there are always circumstances that might have altered a cell's fate" (Purves, 1995). The implication of such observations is meant to be that knowledge about the heritability of human IQ differences would be of only local and short-term significance and so not worth collecting - especially given the dangers of pessimistic misinterpretation; and that genetic effects can never be disentangled from the myriad epigenetic routes and factors on which they depend for their usual expression.

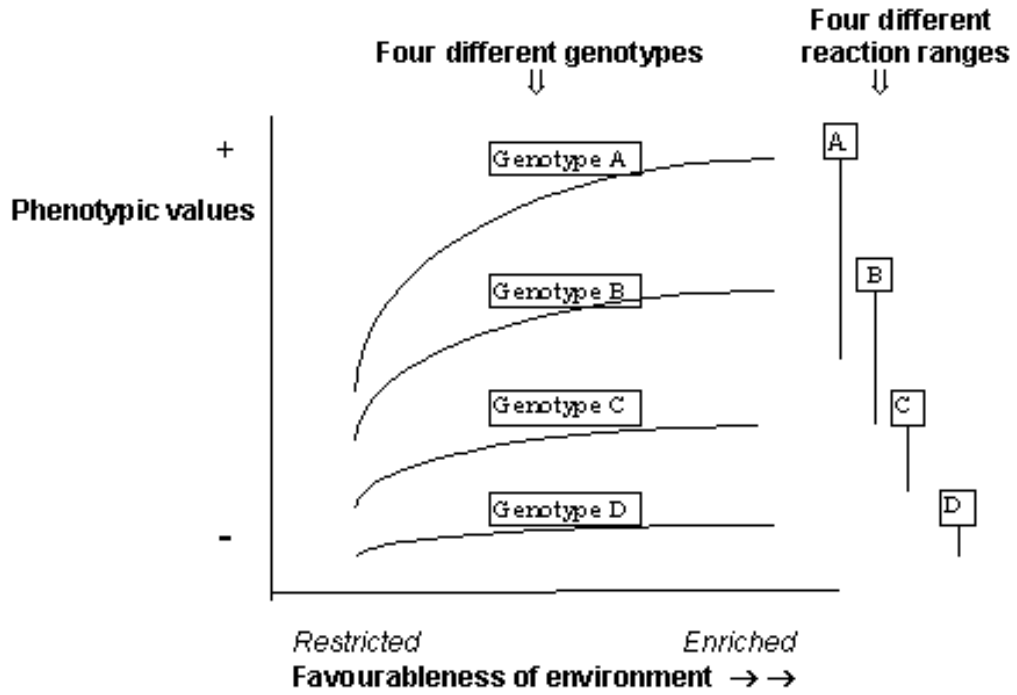


Figure: The different 'reaction ranges' that might be found for different genotypes across the same environmental variation. For example, of all the genotypes, Genotype A shows more final phenotypic variation (perhaps in height or IQ) across the environmental difference represented here. (The genotypes might be different races or strains.)

Which plants thrive, having which genes, may well depend on what conditions of temperature are arranged in the experimental laboratory. Likewise, suppose a random 50% of a country's babies were given some crucial protein boost at birth: actual levels of later intelligence - which may have previously been determined largely by genetic factors - would now be found by researchers to have come under overwhelming environmental control. However, though this is a valuable theoretical point for plant geneticists, it neglects the fact that human beings do not in fact live in a laboratory where an experimenter can thus play around with the determining parameters of human experience - whether such parameters are chiefly genetic, chiefly environmental, or whether they are epigenetic constellations (which vary as little between members of a species as do genes themselves). State provision of free education for all might once have raised the heritability of educational achievements - since a major environmental inequality of the past, in terms of access to education, was being reduced. But human 'populations' are not like plants: they act and choose, maintain valued traditions, and, though there are occasional 'revolutions', there is still much continuity. People do not experience their conditions of existence at the whim of a laboratory geneticist; and most *g* and *E* differences that are relevant to development are unlikely to be capable, within usual ethical provisos, of being suddenly created or abolished.

In any case, even among plants, dramatic shifts in the relevance of genotypes at different environmental extremes are strangely hard to find: would-be critics of

heritability estimation (Lewontin, 1975; Byne, 1994) need to have recourse to data collected in 1940 from races (of the California Achillea plant) which apparently thrive differently at dramatically different altitudes (30m vs 3050m above sea level) (Bouchard, 1995/6). What can possibly be the implications of such a distant example for the study of individual differences between people across environments between which voluntary migration freely occurs? The fact that a heritability estimate might, evidently rarely, have such limitations seems a reason for more genetic studies of populations, not for fewer. Most likely, environment-specific heritabilities are a rarity and those that are 'discovered' are methodological artefacts. One frequently quoted example of reaction range effects in animal learning is Cooper & Zubeck's (1958) finding that 'dull' and 'bright' rat strains were equalized, so that heritability became zero, in an 'enriched' environment. Yet Bouchard (1995/6) observes that the authors of this study expressly explained that the apparent disappearance of their strain difference under enriched conditions could have occurred simply because "the ceiling of the test may have been too low to differentiate the animals, that is, the problems may not have been sufficiently difficult to tax the ability of the bright rats." Moreover, the usual idea of advocates of state welfare is precisely that current, local inequalities in intelligence and self-control have their origins in clear environmental differences and can therefore be corrected by environmental equalization. This important claim surely deserves repeated evaluation: the case for new provision of redistributive welfare expenditure is more easily made when a twin study finds clear environmental effects. An ideological environmentalist may fear that no such environmental influence will be found: only in this case is there an intelligible reason for not wanting research. It is certainly no argument against a trait's heritability to say that new environmental variations could conceivably be created. The same arguments apply about 'epigenetic' effects: staying within ethical limits, the human 'epigenetic landscape' in which cells develop is not readily alterable by experimental intervention; and, even if genetic effects operate via such a landscape in ways that cannot be decisively unravelled, both genetic and epigenetic influences can still be contrasted as a package with the relative influences of observable variations in external environments. If *MZa* twins differ, this must reflect conventional environmental differences (or very rare genetic mutations, or the very special environmental challenges that twins present to each other in the battle for maternal resources in the womb); and if *MZa*'s are phenotypically similar, this must reflect their genetic similarity (and the environment's response to it) no matter how different epigenetic landscapes might have altered everything in the brave new world of an experimenter who wants to distract attention from the issue of heritability.

3. **Non-heritability of fitness characters**. It is sometimes thought that the heritability of IQ cannot be high because intelligence is an important quality for the human race as a whole. If intelligence had been thus important in the course of evolution, downward variations from the population norm would have been disadvantageous to long-term fertility. Natural selection would have reduced heritable differences in the usual way - especially deselecting genes for low intelligence in those human societies based upon agriculture, manufacture and literacy. Thus genetic variance in the population would have become restricted; and remaining phenotypic variance would owe more to environmental variations. By contrast with what is thus expected for intelligence, strongly heritable differences between people are still found for the variable of height. This is presumably because the present range of height

differences has had no specific relation to fitness and has thus not been subject of natural selection. (To judge by requirements advertised lonelyhearts columns, being tall is probably advantageous to the mating prospects of males but not generally to those of females.)

However, this argument against a substantial heritability for IQ differences neglects three special considerations:

1. the help offered to lower-IQ people by individual benefactors, churches, charities and governments;
2. the economic demand (till very recently) for manual labour and basic soldiering and domestic skills; and
3. the rewards available for criminality (even when the criminal is detected, if proceeds have been transferred to kin, and if there are few penalties for a criminal's biological relatives).

So perhaps there need have been no general relation between IQ and fertility over at least the past century. Whatever may have happened across evolutionary history, intellectual limitations could easily have remained perfectly heritable across recent generations in the West; and, since 1970, at least in the USA, out-of-wedlock births have risen sharply among girls and women of below-average IQ (see Chapter IV).*(21)* In short, *g* has not lately been a fitness character: genes for the full range of IQ differences can easily have been passed on.

4. **Irrelevance**. There is one last reason for professional geneticists' unwillingness to research IQ's heritability. Individual differences on g-loaded tests are are normally distributed, so IQ is likely to depend on quite a number of different causal variables, both genetic and environmental (and on a limited number of multiplicative interaction effects between the relevant variables).*(22)* It is sometimes said that perhaps a hundred independent causal factors may be involved in IQ; and no single gene is likely to be crucial. Thus, since no gene therapy can be just around the corner, what really is the point of potentially divisive work on heritability?

   There are however, are four replies to this excuse.

   1. (a) If gene-gene interaction (or epistasis, i.e. G x G) influences a trait, *MZ* twins will be markedly more similar than are *DZ* twins. If a trait were simply, 'additively' heritable, *MZ* 's would be twice as similar as *DZ* 's because *MZ* 's share twice as many gene variations as to *DZ* 's. (DZ twins share, on average, only 50% of the genetic variaions that can occur between human beings: they are no more genetically similar than are ordinary siblings. In addition, being of the same age, they will, over the years, have experienced a slightly more similar family environment than do ordinary siblings.) However, *MZ* twins have in common not only twice as many gene variations but all the possible multiplier effects that can occur between all these genes. (If some entire package of, say, six genes is needed to provide some particular push in the direction of higher intelligence, it is unlikely that two *DZ* 's will share the effect: most likely they will share three of these genetic variations, but there would only be a 1-in-36 chance that they would share all six.) The

phenomenon of more-than-additive similarity for *MZ* 's *does* in fact occur for self-reported personality traits. It is now well known that *MZ* twins correlate at around .40 to .60 for personality traits (depending largely on reliability of measurement) while *DZ* 's correlate at little more than .20 (e.g. Brand, 1989; Baker & Daniels, 1990; Bouchard, 1992, 1994). Thus, at least for the 'Big 5' personality dimensions (see the bipolar ability contrasts of Chapter 1), *MZ* correlations are twice those found amongst *DZ* 's, even though the *MZ* correlations themselves (around .50) show that not more than a half of personality variation can be heritable.*(23)* By contrast, for general intelligence, *DZ* twins show substantial similarity of their own . This indicates that, for intelligence, at least, additive genetic effects, unsupplemented by genetic interactions, can account quite adequately for the observed similarities. (Only for intelligence differences found in late middle age is there evidence of epistasis playing a significant role - see below {III, C, vi} and Pedersen *et al*., 1992.)

2. (b) If there is substantial involvement of *g* x *E* interaction in causation (see above, {Draft 3, Chp III, p.14}), *MZt* twins should be markedly more similar than *MZa* twins. In particular, this difference in similiarity should exceed that between *DZt*'s and *Dza*'s. However, there is no sign of such a phenomenon for intelligence.

3. (c) Good scientific practice would surely test for the occurrence of epistasis and *G* x *E* interaction *before* discarding the possibility that major genes influence intelligence.

4. (d) The Leipzig psychogeneticist, Volkmar Weiss, has argued (as had Goddard*(24)* - see Chapter I) that there may even be just one recessive gene having a rather large effect on IQ levels. Weiss (1992) suggests that some aspects of intelligence, instead of showing the familiar, unimodal, bell-shaped frequency curve, actually show, like eye-colour, a skewed distribution. In some large data sets, it appears that individual intellectual levels might depend importantly on whether gene combinations involve:
    1. the two recessive forms of the gene (and thus IQ's around an average of 130);
    2. the recessive-dominant combination (IQ's around 106); or
    3. the most commonly observed dominant-dominant combination (hypothesized to yield IQ's around 94). (Weiss had to work hard to make his views known. An English geneticist actually reported Weiss's hereditarian 'error' to the East German 'Stasi' - the secret police of the pre-1989 Communist régime - and thus cost Weiss his job as an educational researcher.)

Unlike much of what passes for research today, psychogenetic methods *are* able to mount reasonably decisive tests of causal hypotheses. In particular, it is of the greatest importance to conduct more psychogenetic research before the supply of adopted-away children from mothers of relatively normal intelligence dries up altogether. - Studies of children separated by divorce in

modern times will provide a substitute; but such separations, though far more numerous, are much less clear-cut and thus less able to yield definitive conclusions - even if members of such emotionally divided families were willing to be re-united and co-operate for research purposes. Unfortunately, the sorry tale of Western geneticists and psychologists doing so little to research Burt's eminently viable hypotheses is only just drawing to a close. Psychogenetic research is now achieving funding in the USA and Britain; but this is still for work that would lead lead on to genetic engineering for rare conditions rather than to mainstream genetic counselling. The setting up of the Centre for Social, Genetic and Developmental Psychiatry at the Maudsley Hospital in London is a notable milestone in Britain (Burne, 1994); but even this unit has yet to announce any plans to study general intelligence. In Germany, the only author of a textbook on psychogenetics does not even have a position in a university. Though Weiss's observations may reflect other interaction effects than those of genetic dominance and recession, his having to pass his days as a state genealogist in psychology's home city of Leipzig speaks volumes about the ideological cultivation of ignorance.

Notwithstanding such prevarication, major researches into the heritability of *g* and other psychological dimensions have appeared - all outside Britain and beyond the reach of its institutionalized anti-hereditarianism. Since the setting-aside of Burt's flawed papers, programmes of psychogenetic work involving twins, adoptees or separated half-siblings have been reported from Colorado, Denmark, France, Minnesota, Sweden,

Texas and Virginia. They have had eight notable results, as follows.

1. From Paris, a team headed by former nuclear physicist, Maurice Schiff, used the centralized French educational system to mount a remarkable study of *separated siblings* (Schiff & Lewontin, 1986; Capron & Duyme, 1989). They found and tested adopted children whose biological mothers they could trace. They selected mothers who had themselves gone on to bear and, this time, raise other children - these being full- or half-siblings of the adoptees. (Most commonly, after a first, unwanted child had been adopted, the women went on to marry and to begin families of their own in the usual way - sometimes with the father of the child who had been adopted.) The researchers located thirty-two such separated pairs where the adopted and biological children had reached the beginning of adolescence in homes that were strikingly different in social class. The adoptive parents were of decidedly upper-middle-class status - on average enjoying income levels found in the top ten per cent of French households. By contrast, the biological mothers and their partners provided for their non-adopted children homes that were typically in the bottom half of the range of French income levels.*(25)* Despite the environmentalistic expectations of Schiff's research team in the early days of the research, the effect of the adoptees' 'social advantage' on IQ proved to be slight. By about age twelve, as few as eight IQ points (of fluid intelligence, *gf*) distinguished the privileged adoptees from their brothers and sisters.*(26)* Although the homes of the two groups of children were separated (on average) by 60% of the population

range of class differences, the resulting *g* difference between the children spanned only 12% of the population range of IQ's. Such a slight environmental effect of what sociologists classically take as the crucial feature of a child's home environment was in line with the general (not 100%) hereditarianism of the London School. (It is not always appreciated that Burt, Jensen and Eysenck always reckoned that social class differences accounted, environmentally, for some 15% of population variance in measured IQ - not least because IQ assessment normally draws on a number of techniques, none of which is a pure measure of *g* . Schiff *et al*. were themselves unwilling to admit the compatibility of their findings with Jensen's estimates, but it is readily seen in their work (see Brand, 1987b).)

2. (ii) In Minneapolis, during the 1980's, Tom Bouchard, David Lykken and co-workers brought together the most widely *separated pairs of MZ twins* to have been studied by psychologists.*(27)* Quite often one of the twins, or a friend, wrote in to Minneapolis after reading an article in a newspaper about the project or seeing an advert. Twin pairs were offered a week's accommodation and hospitality in return for co-operating in full medical and psychological examinations. The 48 Minnesota *MZa* pairs were around age forty at the time they were interviewed and tested; and they had typically been separated for some twenty years - from around five months after birth. The pairs' degree and timing of separation turned out to bear no relation to their correlation in overall IQ Their within-pair IQ correlation of .78 was as high as the 40-year test-retest correlation for IQ (see Chapter 1). The twins' home environments had in fact correlated modestly, at .27, for social class; but since the adoptive fathers' SES levels correlated merely at .17 with the eventual IQ's of the twins that they had reared, the similarity between the twins in home SES could not begin to explain their similarity in IQ. (Horgan (1993) is critical of this study; but he simply neglects to consider the above detailed checks for environmental influence that Bouchard *et al*. (1990) had been able to make from their data (see also McGue *et al*.,1993).)

3. (iii) The Texas Adoption Study has furnished modern evidence of correlations for IQ between some 200 *adoptees* and their unseen biological parents (Loehlin *et al*., 1989). Even in childhood, while the adoptive child's environment is created and controlled by the adoptive parents, adoptees' Wechsler IQ correlations with the biological mother are almost double those with the adoptive mother (.23, .13); and by mid-adolescence, this difference is even greater (.26, .05) - reflecting presumably the greater influence of the adolescent child (and thus of its biological mother's genes) over the local micro-environment. In the past, adoption studies were sometimes claimed to be difficult to interpret because of restrictions of range of environments (since adoptive homes are often 'middle class'); or because of selective placement of adoptees with families having educational levels similar to those of biological parents. Such possibilities do not account for the discrepancy between the 'biological' and 'adoptive' correlations in the Texas Study. Adoptive mother's showed r's between their achieved SES and IQ of .45, indicating normal ranges; and children of brighter biological mothers did tend to go to the higher-SES homes. But home SES correlated little with adoptees' IQ's either in childhood or adolescence (.14, .11); and the biological mothers' IQs bore no relation (as a placement hypothesis would predict) to the IQ's of other children in the adoptive family. Hoffman (1991) suggests that correlations between adoptive parents and their children may be somehow 'irrelevant' as an estimate of environmental

influence on children. This suggestion may pave the way to new thinking, but it must amaze genuine supporters of social-environmentalist ideas.

4. (iv) As well as the above confirmations of the traditional views of academic hereditarians, modern research has also produced some novelties. The first of these is that, as *MZ and DZ twins* develop through childhood and adolescence, they seem to diverge increasingly in their degree of similarity. The correlations between *MZ* twins stay high, but those for *DZ* twins decrease (e.g. Scarr, 1992). This was how active *G*,*E*cov (or 'transaction'), was first demonstrated in studies of intelligence. The obvious interpretation of the finding is that the genotypic differences between DZs play out in the later, less parent-dominated years of adolescence: the DZs' biological differences make for the same differences in *niche*-selection or *milieu*-creation that occur between ordinary siblings. These micro-environmental differences may in turn push the DZs further apart in measured IQ. Similarly, it turns out in modern research that the classic .25 correlation between unrelated adoptees for IQ is limited to the years of early childhood. By adulthood, once co-adoptees have had the opportunity to express their genetic differences, results from the four studies conducted show that even this slight r has reduced to -.01 (Plomin, 1989; McGue *et al*., 1993).

5. (v) *G*, *E*cov has also been found much earlier in childhood - using adult twins' memories of how their parents handled them. Even when reared apart, in homes having little correlation in social class, *MZa* twins are likely to have been treated more similarly than DZas; and MZs also report more similar treatment from their peer groups in childhood and adolescence. (Parental child-rearing practices were reported by the twins themselves as adults. Such memories are notoriously unreliable, so it is remarkable that any similarities of treatment for *MZa*'s should have been detectable. For the treatment received by twins from their peer groups see Baker & Daniels,1990.) Early 'environment' is thus itself partly 'genetic': parents of *MZa* twins evidently adjust their demands and practices to fit in with their children's own genetically influenced proclivities and personalities. After the behaviourist generation, Bell (1968) was the first psychologist to give house-room to an idea that behaviouristic social psychologists and 'interactionist' developmental psychologists would still long resist: that, instead of parental behaviour being a cause of child behaviour, it is often an effect. As Sandra Scarr (1992, p.14) put it: children "evoke responses from others, actively select or ignore opportunities, and construct their own experiences." Bouchard (1994) observes: "Current thinking holds that each individual picks and chooses from a range of stimuli and events largely on the basis of his or her own genotype, and creates a unique set of experiences - that is, people help to create their own environments." (That is not to say that early environmental similarities, even when genetically triggered, are invariably part of a causal chain: twin researchers usually find that similar parental handling (e.g. being dressed alike) is not predictive of later psychological similarity: the typical r is around .05 (Loehlin & Nichols, 1976; Bouchard, 1995/6).)

6. (vi) A further novelty from modern psychogenetic work is the growing awareness that *adult lifespan development* does not simply continue the causal processes of childhood. The Minnesota work on adult twins has been followed by a study of 65-year-olds in Finland showing just as large an *MZa* correlation (.78), together with a

much lower *DZ* correlation (.22): this yields a particularly large *MZ* - *DZ* difference in similarity (.56) (Pedersen *et al*., 1992). Further, in the Finnish study, that the twins had been reared together (rather than apart) made no difference, by late middle age, to their degree of similarity. (Indeed, the DZts (r = .23) were actually less similar in IQ than were the DZas. For a general consideration of how DZts grow apart with age, see McCartney *et al*., 1990: presumably the twins' different genes gradually establish more influence over their micro-environments.) All these observations are compatible with the idea that genetic factors (*epistatic* and *active-G*, *E*$_{COV}$ as much as *additive*) are overwhelmingly important in determining late-middle-age levels of intelligence. Apparently, the longer the time span across which genes operate, especially via a person's micro-environment, the greater is their effect on *g* . By contrast, the imposed environmental differences that are involved in different types of homes and styles of parenting seem to affect the children only in early childhood, and not beyond. (The more demanding and punitive homes of former centuries may, of course, have had greater impact - thus accounting for the widespread belief in the importance of 'early conditioning'.)

7. (vii) Estimates can be made of the degree to which individuals' genetic similarity on one test is correlated with their *genetic similarity* on another: for example, it can be asked whether similarity due to genetic factors on one test yields more phenotypic similarity in other test scores than is usually found. Using data from the Colorado Adoption Project results of such calculations so far have been that "genetic influences on all specific cognitive abilities overlap to a surprising degree" and that "genetic effects on scholastic achievement overlap completely with genetic effects on general cognitive ability" (Plomin *et al*., 1994). In other words, instead of separate abilities being inherited separately, their heritability is principally the result of the genetic variance that yields the *g* factor.

8. (viii) One last and novel type of analysis is interesting, even though results are presently inconclusive. Detterman *et al*. (1990) found *MZ* within-pair differences to be smaller, and *DZ* differences to be greater at *below IQ 90*: the heritability for IQ may thus be greater in the lower-g than in the higher-g range. This would fit with the observations (see Chapters I and II) that *g* is itself somewhat more 'unitary', and is more strongly correlated with 'intake speed' at lower levels of intelligence. It would especially add to the impression that more elementary aspects of intelligence are under greater genetic influence; and it would suggest that it is when *g* itself is already above average that environmental differences might contribute especially to whether really high levels are found of intellect, excellence and *g* itself.

Why was so little done till recently to deploy the empirical methods of twin and adoption study? After all, the methods were in use on with significant numbers of cases by the1930's (Burks, 1928; Leahy, 1935; Rosanoff *et al*., 1937; Skodak & Skeels, 1949). Admittedly there were design limitations such as restrictions of relevant variance (especially amongst adoptive parents - who tend to be middle class): these meant that interpretation of the results remained controversial - see e.g., Kamin & Eysenck, 1980. Yet such problems were remediable - if the efforts had been made that went into the study of the laboratory rat; so other explanations are required. At first, a too ready assumption that

'nature' was all-important meant that the first twin study was only conducted (in Germany) in 1920*(28)*; and, until the rise of behaviourism, few could believe that the case for heredity would ever need to be proved. Latterly, however, the problem has been antipathy not only to crude hereditarian and eugenic ideas but to any research that might falsify psychology's long-reigning paradigm of simplistic environmentalism - or of the latter-day interactionist replacement. It was probably the very environmentalist biases of psychologists in Britain after that led Burt to overplay his hand - temporarily most damaging to hereditarianism as his mischief proved. Today, Burt's conclusions have been entirely vindicated and this makes it hard to believe that he and his lady research assistants*(29)* never had any relevant data to analyse (even if twin results from other researchers were incorporated); and the continuing shortage of psychogenetic data in Britain is plainly the fault of Burt's opponents.

Despite the experts in human genetics and development who plainly preferred the position of the ostrich, the psychogenetics of intelligence has consolidated traditional claims and broken new ground. Unfortunately, adoption and twin studies suffer from not spanning the entire range of human genotypes and environments in the data that they can collect; and it is likely that both heritable and environmental influences are somewhat obscured if (as Burt first mooted) family environmental differences interact especially with higher levels of IQ (Scarr-Salapatek, 1971). But, bearing in mind such special effects (which themselves require much more testimony from research) it is true that adoptive children have seemed generally more similar in IQ to their biological (r = .43) than to their adoptive mothers (r = .14) (e.g. Munsinger, 1975, 1978); and that *MZ* twins are markedly more similar than *DZ* twins (e.g. McGue *et al*., 1993b) - especially in adulthood, by which time *MZ* r' s are around .80 and *DZ* r's are around .40.*(30)* The last claim by environmentalists to detect really low *MZ* similarity other than by *post hoc* means is apparently that of Schwartz & Schwartz, 1974. However, this paper merely reanalyses data on child twins whose zygosity was never ascertained: instead, dissimilarity in sex was used as a (very partial) substitute for attributing dizygosity. The original author, Sandra Scarr-Salapatek (1972), said that she herself "hesitated to guess what the standard error of an estimated intraclass correlation coefficient might be." Further, she pointed out that 247 of her 1239 pairs of Philadelphia twins had been lost to the research - often when one or both were in 'special' classes: "Certainly, the low-aptitude end of the distribution was lost." Adams *et al*. (1976) reported nationally representative, 11-year-old MZs (41 pairs, r = .76) to be little more similar than same-sex *DZ* 's (55 pairs, r = .60) on a non-verbal IQ-type test; but (almost incredibly, reflecting lack of interest in twins and IQ in what was a major British longitudinal study) zygosity had not been determined by blood sample, and the test had, the authors admit, "not been cross-validated with better-known, standardised tests." In the report from Japan of the largest-ever number of *MZ* 's, MZr was .78 (N = 543 pairs) and DZr was .49 (N = 161 pairs) (Lynn & Hattori, 1990).

Certainly among those psychologists who claim any expertise in intelligence testing, there is overwhelming acceptance that individual genetic inheritance contributes to human variations. Considering Mackintosh's (1975) defence of psychogenetic studies of IQ against Leon Kamin's critique, even Evans and Waites (1981, p.217) had rejected Kamin's "zero heritability hypothesis." (They rejected likewise the 100% heritability hypothesis (which no hereditarian scholar had held) and also the very effort to quantify heritability (h^2).*(31)* While all measures have their limitations, the heritabilities of human differences are thus assigned to a select club of estimates that should never be made - a club having

IQ itself as its other well-known member.) A survey of 661 such American IQ-test professionals found them just as politically 'liberal' as the journalists and broadcasters who so often decry the idea of genetic involvement in IQ; and these experts in testing rated Sir Cyril Burt the lowest of fourteen leading writers about IQ. Nevertheless, 94% were persuaded of a genetic involvement in IQ by one or other of the types of research evidence considered in the present chapter; and the average of their estimates of the percentage of population variance in IQ attributable to genetic factors (i.e. of the 'broad heritability' of IQ, h^2 B) was 59.6% for whites and 57.1% for blacks (Snyderman & Rothman, 1988; Gottfredson, 1994). Kamin (1974, p.1) had written: "There exist no data which should lead a prudent man to accept the hypothesis that IQ scores are in any degree heritable." But he had not persuaded the experts. In 1994, fifty professors claiming expertise on intelligence placed a full-page advertisement in The Wall Street Journal to attest the measurability and importance of intelligence: they observed that serious empirical estimates of its heritability range between 40% and 80% (Arvey *et al*., 1994).

As to the most crucial source of evidence, the simplest of the methods provides a clear result. There are just five methodologically adequate studies of *MZa* twins (1937, 1962, 1980, 1990, 1992 - yielding 180 such pairs for most analyses). They involve many different IQ measures in five countries and three languages. They give a weighted average within-pair correlation of .75 for IQ - scarcely less than the r of .771 for which Kamin took Burt to task; and attempts to attribute twin similarity to similar homes or to physical similarities (including 'attractiveness' - Farber, 1980; Taylor, 1980; Ford, 1993) have failed (Loehlin, 1981; Locurto, 1991; Bouchard, 1982, 1983, 1995/6). For example, when *MZa* pairs who are alleged to have had especially similar homes have been set aside, the remaining twins still show just as strong within-pair correlations for IQ; and objectively assessed *attractiveness* to others, though it correlates a little with sexual experience in adolescence (.18), has no general correlation at all with intelligence (.00) or with other personality features. Because of their adoption, only a few *MZa* twins have grown up in real poverty or with illiterate parents, and this will have reduced the range of environmental differences among them. At the same time, researchers' twins involve many healthy volunteers who are interested in research and have only 90% of the population range of IQ's: so, equally, they do not represent the full range of genetic differences.

Finally, it is appreciated today that there is a powerful environmental influence that applies uniquely to MZs and must push members of twin pairs apart in ways that will not apply to singletons. Monochorionic MZs are likely to suffer 'twin transfusion syndrome' in their competition in the womb for maternal resources: in effect, within the one chorion, one twin can 'steal' the other's blood supply. This results in one twin being large and plethoric and the other smaller and anaemic at birth, and in a 7% mortality of such twins (Phillips, 1993). Pairs of monochorionic MZs are 150g lighter at birth, and the two twins differ more among themselves in birthweight than do *DZ* twins (who never share the maternal chorion so cannot engage in this type of competition). Congenital malformations are suffered by 3.5% of monochorionic MZs, as compared to 0.25% of dichorionic MZs. In line with this finding, Storfer (1990) noticed that *MZ* 's IQ differences are associated with birthweight differences, and Jensen (1995) has observed that bigger differences in IQ between *MZ* twins occur in those pairs where one of the twins has a particularly low IQ. Thus, assuming that resticted foetal blood supply will depress the IQ of the affected twin, monochorionic *MZ* 's will actually be less similar than if they had developed, as do

ordinary children, in the wombs of different mothers. Because of this special environmental dissimilarity, *MZ* r's will underestimate heritabilities in the normal population. It has often been said that *MZ* 's are treated similarly (or 'placed' similarly when separated); so it has been necessary for hereditarians to point out that parental handling is often a response to a child's nature rather than an imposition by the parents, and that parental handling anyhow shows little correlation with IQ (or with other personality features). Today, however, the discovery of monochorionic hazards make it clear that *MZ* correlations will have underestimated the importance of genetic factors for IQ.

Since they have all their genes (and thus all their gene-gene interaction effects, genetic dominance-recession effects and active *G*, *E*$_{COV}$) in common, *MZa*s provide the best estimate of the broad heritability of measured IQ differences. [Broad heritability is wider concept than is *narrow* heritability, which itself involves simply the additive genetic influences that principally account for genetic similarities between parents and their offspring. For IQ, narrow heritability itself is probably around 45% (Pedersen *et al*., 1992) - as was first concluded by Burt (see Burt & Howard, 1971): via nature and nurture together, parents pass on around 55% of their own mean difference from the population IQ of 100; but, along with the 45% from inherited genetic variations which this 55% includes, there is a 10% environmental component in this transmission - at least in childhood, as in the data of Schiff *et al*. (op.cit.).] Within normal demographic and environmental ranges of the mid-twentieth century West, the *MZa* correlation indicates a broad heritability of IQ of around 75%. Spelling this out, some 45% of population variation arises from genetic factors that can be transmitted from parents to children [i.e. from *narrowly* heritable factors that can be subjected to selective breeding], and a further 30% arises from genetic factors that are not conventionally [i.e. *narrowly*] 'inherited'. The remaining 25% of population variance in IQ occurs because of the environmental differences between homes (10%), other environmental influences (5%) and sheer test unreliability (around 10%). All such percentage estimates must be understood in conjunction with the considerations raised in this chapter - they make no range corrections or allowance for monochorionicity, for example. However, a broad heritability estimate of 75% is one way of saying that any 'zero heritability' hypothesis is totally unreasonable; and that a mere 35% estimate, say, would be quite unlikely within twentieth-century Western parameters. And this should be no surprise to common sense: for "perhaps the most dramatic evidence of genetic influence is typically overlooked" - "the sheer number of children who exhibit high levels of talent and who are found in the most unlikely environmental circumstances" (Humphreys, 1994).

To some, however, it has seemed proper to refrain from 'insensitive' researches that could spread gloom and bitterness in society. Even if they can mount little argument against a 75% estimate, they still hope that new champions of social environmentalism will arise. To them, high heritability coefficients speak of dread determinism and likely state manipulation. Yet where is the threat in intelligence being largely inherited and influencing people's own selections of their personal environments? What is the point of a freedom that is not guided by nature - of a freedom that does not, among other things, achieve a correspondence between opportunities and abilities? What is it that can actually be done to help children, potential parents and minority groups if belief in the inheritance of *g* could

somehow be kept at bay? The next chapter will discuss the importance of IQ differences and the proper educational response to them. But if IQ is not involved in education, its heritability can surely not matter. Alternatively, if IQ is actually a useful predictor and guide to action in education, how could the world possibly be a safer place for any insistence by new champions of environmentalism that IQ's heritability is low, unknown or unknowable?

Since disagreeable and dangerous practices are often feared to follow from hereditarian beliefs, it is worth examining the practices that would follow naturally in the wake of *environmentalism*. What if the usual IQ correlation of .50 between parents and children had in fact been shown to result from nothing but the environments that are supplied by different parents? What if *MZ* 's had proved no more similar in phenotype than *DZ* 's? Would determinism have been overthrown? Would not one causal account just have been replaced with another? And would such a reversal of hereditarianism have policy implications that were strictly anodyne? After all, if maximum reductions were desired in illiteracy, criminality and unemployability in future generations, it would still be necessary to help duller parents (quite the most common suppliers of low-stimulation, low-supervision, high-punishment, high-child-abuse home environments (Herrnstein & Murray, 1994)) to restrict their family sizes. It can hardly matter to the committed social improver and utopian whether the children of lower-IQ families would have had their lower IQ's because of genetic or because of environmental influences. If children of the future are to achieve maximum intellectual and educational levels and to be more employable, there would need to be relatively fewer homes where parents and caretakers were unstimulating, drug-addicted, neglectful, or themselves of low IQ - *even assuming largely environmental origins of g*. When Reed & Reed (1965) collected data on the 80,000 descendants of the grandparents of 289 state colony patients having IQ < 70 (and without epilepsy), they concluded that having a family member showing what have in the 1990's been called 'learning difficulties' was the major predictor of mental retardation in a descendant. Only 88 of the original 289 patients were classified as having retardation of definitely genetic origins; yet retardation ran in families to such an extent that the overall rate of retardation would have been reduced by 50% if retarded people themselves had not had children.

How can progress towards a reduction of low-IQ parenting be achieved? Well, the percentage of such homes in the future population could be reduced by interventions in high-rise mothercare that are expensive, draconian or both. If environmental influences are crucial to intelligence, compulsory fostering can be justified for children who fail to thrive. This is what happens currently in Britain - where youngsters of low IQ are encouraged to have babies by health and welfare officials and by charities concerned with mental handicap. However, even though whole teams of social workers are appointed to assist the mothers and their babies, these babies are the most common target of forcible removal of children from biological parents: whatever their initial personal beliefs in the viability of low-IQ parenting with 'community support', social workers gradually become aware of the humanitarian risks involved.*(32)* Alternatively, progress could be achieved economically and acceptably by voluntary changes in contraceptive practice and mate selection. So what is new? Persuading and assisting lower-IQ people towards selecting contraception, higher-IQ sexual partners, or both would raise the intelligence of the next generation *quite regardless* of 'the heritability of *g* '. Similarly, any would-be parent who regards intelligence as an asset to a child will try to select a relatively bright spouse - no matter whether the correlation between parental and child IQ is expected via the spouse's

genes (nature) or via the spouse's child-rearing skills (nurture)! It would not be well-meaning citizens, would-be parents or even honest social engineers who would need to change their ways if they ever learned that intelligence was actually largely heritable. The parent-child IQ correlation itself shows how to make improvements for the future quite regardless of hereditarian or environmentalist interpretations of how the correlation arises.*(33)* A eugenic policy focussed on IQ must be attractive to any would-be improver of human happiness - *whether hereditarian or environmentalist*.

As if in appreciation of the even-handed appeal of discouragement of low-IQ parenting, advocacy of extended uptake of contraception is sometimes expressly undertaken on environmentalist grounds*(34)*, by scholars who decline to acknowledge any great importance of genetic inheritance in generating major social problems (Flynn, 1992; and see Chapter IV); and, looking further afield, classical Islamic tolerance of polygyny recognizes the value of successful males supporting and rearing larger families. Hence the reasonable anxieties aroused by hereditarian ideas can be no greater than those that would equally be aroused by environmentalist ideas if any attempt were made to derive practical reforms from environmentalist accounts of intelligence. Obscuring the role of genetic factors is usually hoped to delay the arrival of intrusive state policies for family life; but there is quite as much justification for state intervention if low-g parents transmit low *g* to their children mainly via the environment which they supply - assuming that adults of the future are expected to need markedly higher average intelligence than they have today. To use the resources of the state to try to improve the population is an option that is available to environmentalists just as much as to hereditarians; likewise, improvers of both kinds will need to decide, *quite independently of their favoured heritability estimates*, whether to use inducements, appeals to reason or punishments. In the twentieth, human rights have been trampled on by Russian Communists and Third World religious enthusiasts believing in the environmental perfectibility of mankind just as by Nazis believing in the genetic purification of their racial stocks; and today the policy of encouraging sterilization of the mentally abnormal and subnormal is evidently being pursued on a large scale in Communist China.*(35)* It is folly to think that hereditarian beliefs are either uniquely threatening to human rights or in any simple sense 'right-wing'. Acceptance of others' rights is what protects everyone from state manipulation of any kind; and such acceptance follows perhaps a little more easily from a belief in biologically based individual agency than from an environmentalism that stresses the power of society to shape and even 'construct' the individual. The threat of heritable IQ is not to human rights or liberties - which need defending against both genetic and social environmentalist manipulation. Rather, the threat is to ideologues whose own belief systems and particular job prospects dictate that all-round ignorance about causation is bliss. This is why talk of 'complex interaction effects' has been so popular: it keeps all causes in the dark and strengthens the priesthood of Western social experts who imply they have some mastery of the 'many complexities of development' that is superior to what published researches indicate. Virtually any knowledge of causes at all - whether genetic or environmental - challenges those Western experts in welfare and education who have presided over steadily rising levels of crime, single-parenting, illiteracy and unemployability. Far from being able to do better for children than did Sir Cyril Burt, these experts can be argued to have been engaged in such outright deception of the general public about IQ as to put Burt's own self-indulgence quite in the shade (see also Chapter IV).

Nevertheless, though an informed environmentalism that admits its own utopianism is

better than ignorance, piety and mumbo-jumbo, environmentalists do have something of a cross to bear for a while. Not only have they been largely factually wrong in their beliefs about how *g* differences arise, but they have commonly been self-contradictory in their own planned response. To achieve wider practice of contraception unless and until sexual partners are ready to provide a good home for children should plainly be as much a policy objective of serious, progressive environmentalists as of hereditarians; and so must the encouragement of young women to have children only by men who can be relied upon to pay the costs (e.g. from prior insurance) of a modern upbringing. The environmentalist who declines to advocate birth control and greater sexual selectivity is just as hamstrung as any hereditarian whose personal or religious principles forbid even the gentlest interference with human nature. To load the hereditarian with advocacy of extended contraceptive practice, spousal selection and state interference is a moral evasion as thoughtless as it is cowardly. It attracts cheap popularity - but at the expense of making environmentalism incoherent, pointless, timid and supportive chiefly of those who already enjoy official positions in their countries' welfare states. Environmentalists hope to despatching hereditarian truth claims by popularity-courting manoeuvres; but these serve in the end to leave hereditarianism not only with greater credibility and a slight edge on human rights but also with a monopoly of common sense.

CONCLUSIONS

1. There is proper anxiety that a society which believes in the importance of genes may end up violating human rights in the pursuit of compulsory, state-orchestrated eugenics. In part for this reason, modern psychogenetic research into intelligence has been surrounded by acrimony. When Sir Cyril Burt was shown to have used (or even invented) poor-quality data on twins, fresh excuse was provided for the suspicion that London School psychologists and psychogeneticists might have unacceptable motives - even though Burt was much more interested in education than in eugenics.

2. Since Burt's exposure, the more immediate objections to research on nature-nurture questions about intelligence have generally taken the form of denying that anything of value can be discovered. In particular, nature and nurture are said to be so 'closely interwoven' as to be 'inextricable from each other' in their 'complex interaction'.

3. Although research into twins and adoptees, separated or together, could disclose some irresoluble conundrum, and certainly show up any specifiable 'genetic x environmental interactions', it does not in fact do so in the case of *g* . Instead, by adolescence (by which time parental influence is weak in the modern West), unrelated children who have grown up as adoptees in the same family show quite simply no similarity at all in their levels of *g* . As Neisser *et al*. (1995) conclude in their review for the American Psychological Association, "Severely deprived, neglectful or abusive environments must have negative effects on a great many aspects of development, including intelligence. Beyond that minimum, however, the role of family experience is now in serious dispute."

4. Psychogenetic methods are quite able to register and analyse complexity - even though data are all too few because of limited state funding of research. For example, measures of temperament, character and psychopathology currently find: modest (additive) genetic

influence; virtually no influence of the imposed ('between family') environment; and thus much remaining variance to be explained (by *G* x *E interaction*, by *G* x *G* epistasis, and by sibling rivalry). Intelligence, however, is different - even though many of the same investigators are involved. For *g* , there is a strong, 'additive' genetic effect (inherited from parents) and a definite, though modest effect of the imposed environment (in particular, during childhood, of SES and parental IQ). There is also evidence that other genetic effects work to some extent via a growing child's choice of micro-environment. Whether in infancy, adolescence or middle age, modern studies of *g* show people's 'nature' operating via the selection of their 'nurture'.

5. (5) Children's *g* differences arise both from the parental supply of genes and from the parental supply of environments; and working out the balance is of great academic interest. However, for the purpose of raising average levels of intelligence in the future population, the balance of these two types of causal influence matters little. The correlation (of .55) between parents and children of itself ensures that the encouragement of planned and affordable births to intellectually adequate parents would have an improving effect on the *g* levels of children. Hereditarian views have been contested and psychogenetic research frustrated by ideology : there would actually be quite as much reason for discouraging low-IQ parenting if social environmentalist theories about IQ were correct. Obscuring the role of genetic factors is usually hoped to delay the arrival of intrusive state policies for family life; but there is quite as much justification for state intervention if low-g parents transmit low *g* to their children mainly via the environment which they supply - assuming that adults of the future are expected to need higher average intelligence than today. That environmentalists have seldom advocated discouragement of low-IQ parenting probably reflects a certain lack of faith in environmentalism.

ENDNOTES

1. Sidney Webb (1859-1947), the founder of the London School of Economics, was himself a socialist pioneer of the welfare state and of environmental improvement; but he approved Asquith's rhetorical question as being "on the right track" (Webb, 1901). Like many, Webb was horrified by "the stunted, anaemic, demoralised denizens of the slum tenements of our great cities." While Gladstonian Liberals remained "axiomatically hostile to the state", Webb opposed such individualism and "administrative nihilism"; and he insisted that "the maximum of individual development will not be secured by allowing each unit to pursue its own ends without reference to the welfare of the whole." Such sentiments were as congenial to eugenicists as to environmentalists.

2. The term 'eugenics' will be used here in its conventional sense, to refer to the applied science of improving the human gene pool by selectivity in procreation. However, Galton himself had defined it more broadly - see Chapter I, Footnote 4. As genetic engineering throws up new ways of improving the inborn qualities of future generations, perhaps a wider use of the term will develop.

3. In 1934, Huxley publicly commended German legislation for the compulsory sterilization of certified mental defectives. He wrote: "If conditions remain as they are now, and if the present tendency continues unchecked, we may look forward in a century or two to a time when a quarter of the population of these islands will consist of half-wits. What a curiously squalid and humiliating conclusion to English history!....What is the remedy for the present deplorable state of affairs? It consists, obviously, in encouraging the normal and super-normal members of the population to have larger families and in preventing the sub-normal from having any families at all." (Quoted by Robinson, 1995)

4. Nazi patience with the compulsory sterilization that was sanctioned by some of their 'race hygiene' experts ran out by 1937. Simply, euthanasia was quicker and cheaper (especially in releasing hospital beds for military use). Moreover, the Nazis had other objectives that were far from eugenic with regard to IQ. In 1937, IQ testing was banned in Germany so as to restrict awareness of the superior results of even those Jews who had not already escaped. In this flight from reality, Hitler was to be joined by other dictators - for Stalin, Mao and Iran's Ayatollah Khomeini also banned IQ-testing as ideologically unhelpful; and by many US states seeking to justify abolition of forms of educational provision that varied in their relevance to black and white children.

5. The Chairwoman of the European Commission's 'Group of Advisers on the Ethical Implications of Biotechnology' was quoted in New Scientist (24/31 xii 1994, p.11) as wanting to "outlaw" germ-line therapy.

6. In Britain, advocacy of private insurance replacing state welfare activities is undertaken by the Adam Smith Institute, London (Butler, 1995).

7. To challenge Western states' permissiveness of criminality would be to touch the weak spot of modern utopianism and indiscriminate welfarism. At present, government measures against crime include spending on virtually everything except that recompense of costs to which victims would be entitled if their losses were handled under civil, instead of under criminal law.

8. Nazi social practices had little connection with the findings of science; and Nazi beliefs in the blue-eyed Aryan race, in the mental and moral inferiority of Jews, Slavs and homosexuals, and in the value of unquestioning loyalty to the Führer all proved positively costly fictions.

9. McDougall would go on to Harvard and be the Chairman of the Psychology Department there while Yerkes was conducting the earliest work on group testing of IQ (see Chapter I).

10. Gould (1981) makes the interesting suggestion that, in comparison to the 'Aristotelian' Spearman, Burt could be considered somewhat more of a 'Platonic' realist in his lofty and non-materially-grounded conception of mental reality. However, there was no such overt contest between the two men; and it was Burt who took more interest in gathering data relevant to the question of whether *g* had some definite biological basis.

11. There were two main eugenic proposals regarding the mentally retarded: colonization and sterilization. Compulsory sterilization of mentally defective girls was first permitted in Indiana in 1908. By 1930, some thirty states of the USA had passed similar legislation. Castration of rapists was popular in several European countries - being especially supported by women's groups; and eventually the Nazis seem to have sterilized about one woman in thirty in urban areas (if the case of Hamburg is representative). Throughout this period Britain enacted no specifically eugenic enabling legislation; but large-scale compulsory hospitalization of the mentally ill and the mentally retarded invariably segregated them to locked, single-sex wards that provided few heterosexual opportunities and thus constituted a de facto version of colonization. (Colonization was the preferred option of most IQ psychologists: for example, the keen eugenicist, H.H.Goddard (1919) held that sterilization was too far out of step with traditional sensibilities.)

12. For differing views of Burt's responsibility for the post-War changes, see Sutherland, 1995, and Wooldridge, 1994. By 1943, Burt was sixty years old, living in Aberystwyth (to which University College London had been evacuated) and suffering from Menière's disease and hearing loss; but his influence in the 1930's had been substantial - as would be expected from his occupancy of what was then the most prestigious chair of psychology in Britain.

13. This was at a time when places in the state-funded grammar schools of Britain were available for only about one child in ten.

14. Graduates are relatively successful in gaining employment, but only because of their age and IQ's; and, reflecting the limited impact of today's first degrees, it is now rare for professional and administrative

careers to begin until aspirants reach their late-twenties.

15. However, the hereditarian JamesShields (1962) had discounted Burt's 1943 report (of 15 *MZa* pairs) as lacking adequate detail. It may have been this embarrassing dismissal of his work that spurred Burt to take the matter up once more in 1966.

16. At very least, Burt's own data had been collected and recorded skimpily and haphazardly; and, to supplement genuine data of his own, Burt may have used without acknowledgment some of the data published by others. (The *MZa* data set out so fully by Burt's young rival, James Shields (1962), yielded almost exactly the same *MZa* correlation as Burt reported.) In fairness to Burt, he cannot be accused of fabricating elaborate details of studies that were never conducted: like most psychological research reports today (which provide little detail of testees or their motivations for participation - to disguise the fact that subjects are usually psychology students) Burt's papers are written as if making the best of rather poor data about which 'the less said, the better'. However, Burt can certainly be blamed for: (i) not admitting the loss of at least some of his data (perhaps in wartime bomb damage at University College London); (ii) implying that the minimal data that might have been reported to him by former students deserved full-scale journal articles - with or without supplementation from already published cases; and (iii) illustrating methodological points in ways that could mislead readers into thinking that real data were being discussed. [The latter problem was first noted by Jensen (1974); but a spectacular example was furnished later by Dorfman (1978). Burt had discussed the class distribution of IQ using figures that yielded an impossibly perfect bell-shaped (Gaussian) distribution. However, Burt's IQ distribution was more regular than the normal distribution of the heights of the 67,000 soldiers measured during in the American Civil War. (It was this bell-shaped distribution which had first suggested to statisticians the likely causal play of multiple, independent factors in yielding human differences.)] The scientist who has messy, real-life data faces an unenviable choice that can be called Dorfman's Fork (after Dorfman, 1995). If he publishes in a top scientific journal, Dorfman will accuse him of not providing the essential details that require exposition; and if he publishes a 845-page book, Dorfman will accuse him of not taking his data to a top scientific journal.

17. 'Hereditarians' believe - sometimes from evidence, sometimes from prejudice - that many important human features are either inherited from parents or have some other genetic basis (as when recessive genes allow expression of a trait rarely seen in the rest of a family). By contrast, 'methodological solipsists' believe there is no way of knowing the degree to which a character is under genetic influence: one eminent professor of genetics in Scotland used to claim in the 1970's that, despite a century of genetical science, it was simply not known even whether human differences in height are heritable. In their corner, 'environmentalists' believe that observable phenotypic differences in the population arise from people having experienced different physical or social environments or events. Some environmentalists stress the involvement of culture and language in all human experiences and outcomes, and thus hope to avoid testing their (often idealistic) beliefs against any evidence at all regarding individual differences; other environmentalists just take the influences of different families to be so obvious as to need no further explicit testing. (For whichever reasons, most environmentalists prefer to criticize all methods of psychogenetic enquiry rather than conduct studies of their own - the Paris team of Schiff *et al*.(1986) being an honourable exception. Environmentalism thus tends to shade into methodological solipsism.) For a fourth, very popular 'interactionist' position, see later in this Chapter, p.{Draft 4: 15}. (Some versions of 'interactionism' also shade into methodological solipsism: for example, testing for 'complex interaction effects' (on the rare occasion of these being spelled out) is impossible without large data sets that interactionists show little propensity to collect.)

18. 'Selective placement' was motivated by two considerations: that the adoptee should have adoptive parents who would be understanding; and that the adoptee should not stand out like a sore thumb in the adoptive home - e.g. by having brown eyes when the eyes of the adoptive parents were blue.

19. 'Phenotype' is the technical term in genetics for what is observable, on-the-surface and measurable, as distinct from the hidden 'genotype' that the geneticist seeks to read.

20. The first recorded appearance of the 'areas' argument for the 'inextricability of genes and environment' was during a sabbatical visit by Hans Eysenck to the Berkeley campus of the University of California in the 1960's. The argument is still heard today, even from academics who are sympathetic to

hereditarianism: "I think the idea of nature versus nurture is silly. It's like asking, 'Is it longer to New York or by train?' Or, as one friend of mine likes to say, 'Is the area of the rectangle caused by the length or the width?" (Professor R.Masters, interviewed by K.McDonald, 1994). - The answer is 'Yes: differences of areas among a number of rectangles can be wholly explicable by reference only to their differing lengths - or widths. For a particular collection of rectangles may all be equal to each other in widths - or lengths.' Refusal to 'separate nature from nurture' and to answer questions about how individual differences most likely arise is still part of the Piagetian position (e.g. Annette Karmiloff-Smith, 1995, BBC IV UK, 18 xii, 09.45hrs).

21. Herrnstein & Murray (1994) report for the years around1990 the same soaring rate of out-of-wedlock births among white American females that occurred among black American females around 1970.

22. (i) A normal distribution is the bell-shaped frequency distribution that will result from a quantifiable trait being under the influence of multiple uncorrelated influences. If a coin is tossed twelve times, it will more likely come down as heads on six of the trials than on just one or on as many as twelve of the trials. Similarly, when a number of unrelated chance factors influence people's scores on a final variable, most scores will be in the middle of the final phenotypic range and few will be at the extremes. (ii) Ordinary statistical interaction - as distinct from the Piagetian variety considered in Chapter II - occurs when scores on variable Z can be predicted by weighting and multiplying together testees' scores on variables X and Y. To the extent that there are substantial positive interaction effects between several of the relevant variables, the resulting distribution will tend to lose its bell-shaped distribution and become skewed.

23. Variables like extraversion, neuroticism/emotionality, conscientiousness, will /disagreeableness, and affection /openness [i.e. the 'big five' personality dimensions other than *g* - see Chapter I] all yield these effects [with perhaps lower *MZ* similarities for will (Brand, 1994a)]; and the tendency for 'psychotic' personality characteristics (e.g., in questionnaire measurement, suspicion and disillusionmnent) to show such a picture is specially marked. The usual interpretation is that, when the genetic packages of epistasis are crucial to trait levels, two people need an especially high proportion of their genes in common if marked phenotypic similarity is to be observed. Only at *MZ* levels of genotypic similarity (i.e. near 100%) are virtually all genetic 'packages' be held in common between two people; so especially high *MZ* correlations occurring while correlations for ordinary first-degree relatives are low will indicate that epistasis is at work. For the calculation of the 'heritability' of a trait, see below, Note III, 32.

24. H.H.Goddard was the American popularizer of IQ and pioneer of research into children of around IQ 70. In the 1920's he was director of research at the Vineland Training School for Feeble-Minded Girls and Boys in New Jersey.

25. By French standards of the time, the adoptive parents were 1,5 standard deviations high in socio-economic status (SES). In contrast, the homes provided by the biological mothers were, on average, 1 standard deviation low in SES.

26. Each standard deviation of SES had thus proved worth only 3 IQ points to the average child. The gap on verbal IQ was a little bigger; and in educational attainment and school record there was a gap of a full standard deviation between the adopted and the biological-mother-reared groups. (It will be of interest to learn whether this environmentally created difference survives adolescence.)

27. Funding came from the 'Pioneer Foundation', based in Washington - an 'old Right' body concerned with demographic issues and the quality of life in North America and usually presumed to set some store by the qualities of the Nordic peoples and to favour the exploration of eugenic social options for the USA. A notable individual initiative was that of a Hertfordshire social worker who, after experiencing the happiness he could bring about by re-uniting siblings who had been parted during the Holocaust, sought to carry on such work by re-uniting twins who had been separated by adoption. (Sometimes one twin was unaware of the other's existence; but delight was the invariable reaction to reunion.)

28. The first discussion of an *MZa* pair was provided by Popenoe (1922) and followed up by Muller (1925)..

29. After Kamin's exposure of the flaws in Burt's, it was often alleged that even his research assistants and co-authors had been an invention. However, testimony subsequently became available from academics

who recalled meeting at least two of the ladies in the 1930's (Joynson, op. cit.). (Psychology degrees are not very vocationally oriented - as shown by their very different content in different universities; so students seldom become professional psychologists and often disappear without trace after graduation.) For a more recent defence of the idea that Burt may well have had data for his key claims, see Brand, 1995b.

30. McGue *et al*. (1993) review evidence from published studies involving 190 *MZ* pairs and 178 *DZ* pairs; and they add 142 MZt pairs and 103 DZt pairs from their own work. These latter Minnesota twins were all ascertained from birth records as described by Lykken *et al*., 1990, thus reducing the likelihood of volunteer bias (the possibility that phenotypically more similar *MZ* 's may be over-represented because of a special interest in twin research).

31. The most commonly used estimate of the degree to which a trait is inherited (i.e. of its heritability, h^2) is to double the difference between *MZ* and *DZ* correlations: 2(rMZ - rDZ). Such 'broad heritability' (h^2 B) estimates range theoretically between zero (when the two types of twin have the same correlation) to 1.00 (if a trait were entirely additively heritable and *MZ* twins correlated at 1.00 - twice as highly as *DZ* 's, in line with their having twice as many genes in common [of those genes for which there is any substantial species variation]). In the early 1980's, because of some studies that did not involve a representatively wide range of IQ's, some put the h^2 B for IQ as low as .55. Some psychogeneticists would perhaps be content with that today, thinking that the more modern studies mentioned in this chapter have perhaps not involved a wide enough range of social environments. (Obviously - whatever social workers may arrange today to avoid cross-racial adoptions - adoptees of the past were not sent by agencies to homes of drug addicts in inner-city high-rise urban ghettoes having today's rates of truancy, crime and welfare dependency.) However, the majority of psychogeneticists and differential psychologists today would estimate h^2 B for I.Q. in modern Western conditions - with colour T.V. widely available, and with none but voluntary malnutrition - as being >.70; though, due to parental control of the environment in the early years, the figure may well be lower in young children than in adults.

32. Selection pressure will reduce the 'narrow heritability' (h2N). h2N is the degree to which a phenotypic trait is passed genetically from one generation to the next: it quantifies the genetic variance that 'breeds true', making individuals more similar as a simple linear function of the percentage of genes that they should have in common (at any level of biological relationship). However, other genetic effects, e.g. those arising from genes being dominant or recessive, or from multiplier effects between genes (epistasis), make an additional contribution to the degree to which, in the population as a whole, a trait has high h2B. Thus genes that make (narrowly, additively) for low intelligence might disappear in response to natural selection; but genes that only make for low intelligence when combined with other *G* or *E* features could survive a particular selection pressure that operates against their non-interactive manifestations.

33. Details of two such cases were broadcast on 'Face the Facts', BBC IV UK, 15 vi 1995.

34. I am indebted to Lloyd Humphries for the essential idea behind this paragraph - though I must take any blame for the way in which it is expressed.

35. Discouragement of low-IQ parenting so that future children will enjoy more stimulating (etc.) environments and thus have higher IQ's themselves could actually be called 'eugenic' under Galton's original broad definition - see Chapter I, Note 4, ii. (If genes and environment both contribute to *g* , then an environmental improvement would be 'improving inborn quality' and 'developing it to the utmost advantage'; thus the improvement would fall under Galton's broad notion of a eugenic measure.)

36. A major programme of encouraging the sterilization of both men and women having psychological abnormalities has been in operation in the north of China since 1990 (BBC IV UK News, 1 vi 1995, 0745a.m.). Apparently the programme is regarded as an experiment which, if successful, will be extended to the rest of China.

IV - Intelligence in Society - *the practical importance of g differences*

- *Is realism avoidable?*
- *Believing in g and that it can be raised: Jensen and Head Start.*
- *Disputing the importance of g:*
  - *Ceci - savants, gamblers, school causes;*
  - *Flynn - the worldwide rise in IQ test scores, & race;*
  - *Howe - IQ only a number.*
- *Merits of streaming according to mental age.*
- *Embracing realism: pupil empowerment (track choice).*

OUTLINE

Today's evidence is that there exists a strong general, apprehensional and genetic factor that yields much of the variance between people in mental abilities. The evidence is far superior to was available to Binet, Spearman or Burt. But what if there are also racial differences in *g?* What if massive public expenditures have yielded no sign as yet that children's IQ's can be lastingly raised by conventional state endeavours? What if, despite great hopes, people can still not improve their own intelligence by vitamins or mental gymnastics? When pessimism seems to beckon, to dispute that *g* is important becomes an attractive option. At least for the purposes of conversation in polite or multicultural society, perhaps the topic of *g* can just be avoided? The present Chapter thus considers four modern attempts to play down the importance of *g* - and especially the major critical campaign mounted by James Flynn.

Whatever may be the importance of *g* as a causal variable influencing life-chances, there is a further, more particular question about the relevance of *g* differences to education. Have educators understood how to respond to *g* differences? In the second half of this Chapter, it is argued that both children's educational attainments and their happiness at school depend on achieving the right combination of intelligence and teaching; and that, even without any re-introduction of IQ testing, selective schools or compulsory streaming, new and far-reaching educational breakthroughs for children can be achieved today by taking the *g* factor seriously.

As new psychogenetic work came on stream around 1990, the Burt Affair and the anti-realism that it had encouraged were becoming ancient history. Genetic causation and possible feats of genetic engineering were increasingly acknowledged as the key realities of modern agriculture, medicine and psychiatry. Thomas Kuhn's anxious relativism and philosophical idealism had been answered by a triumphantly accelerated advance of science and technology (Hobsbawm, 1994) - as if a deeply structured 'real world' did indeed exist and scientists could reveal, measure and harness its secrets quite successfully. In psychology itself, the main alternative to admitting the role of genetic factors had failed to deliver: the latter-day behaviourist attempt to understand people in terms of their 'situations' could not survive psychologists' growing appreciation that 'situations' usually reflect personal choices made according to deeper-seated proclivities. Social environmentalism had long dominated expert discussions of welfare and educational policy in Britain and North America, and the Burt Affair helped keep it alive; but *g* had not been broken up into numerous 'differential aptitudes' or 'cognitive components' or been shown to be a

mere verbal label. Instead, IQ's generality and fairness (Chapter I), its link with speed of apprehension (Chapter II), and its primary basis in genetic differences (Chapter III) had all been re-affirmed.

Nevertheless, *g* might still require no more attention from politicians or educators than do human differences in, say, handedness, musical preferences or table manners. Especially when compared to variables in medicine and social science like health, fertility, religion or wealth, *g* might simply not matter very much. Even to educators, mass compulsory secondary education may seem to require no hard choices about what can be taught to whom, or how. Children may differ intellectually in measurable ways, and perhaps because of genetic factors; but such differences can be officially ignored. All children can be supplied with simple curricula which they can all manage - even if success at what will often be undemanding lessons equips even the most able of them only for entry to more of the same slow-paced education. Such a long race of low hurdles can even be claimed to cater for individual differences: after all, some students can simply drop out earlier than others. And dropout can hardly be blamed on the educators: all children have being given 'the same chances' - even if these are not in fact the best chances for most of the children. Ordinary citizens themselves can think of occasions where it is tactless to mention intellectual differences without hedging as to their importance, fixity, deep-seatedness or generality: rather than acknowledge the main facts of educational achievement, it is easier to pretend that any poor student can catch up by hard work. To talk of 'mere academic intelligence' as 'irrelevant' has often seemed the easiest of these options to modern educationalists: it licenses arranging education without any regard to *g* .

The importance of differences in general intelligence, especially to human achievements, was first urged by Galton (see Chapter I). From historical records of national biography, he had shown that eminent men in Britain came from a relatively small number of families. Such inheritance was especially notable for musical, literary and scientific achievement; and Galton himself was well pleased that he and his second cousin, Charles Darwin, could trace their own ancestry back to Charlemagne. However, although his ambitions, energy and clarity of vision assured him a lasting reputation, Galton had little luck in his own researches on virtually any aspect of intelligence. He failed to come up with a direct measure of intelligence: without that, even his promising tests of tone thresholds and short-term memory on his 9,000 fee-paying testees could hardly clarify its essential psychological nature. Though he was the first to suggest twin studies into mental abilities, his own work was inconclusive; his Victorian presuppositions as to the intellectual inferiority of women and Jews were soon disproved by his descendants in differential psychology;*(1)* and the inheritance of genius that he had discovered may have been as much social as genetic - Galton himself believed that it was a mother's stress on telling the truth that would lead her children into the paths of science.

Nevertheless, Galton's stress on the importance of intelligence was popular in his own day and for the next half-century. It could have remained popular: the taking of IQ's would have seemed mere 'common sense' if only educationists had been required to demonstrate the success of their teaching. For example, it is expected that education should benefit both boys and girls, and not just one of the two sexes; and modern educators reliably profess distress if, say, boys do better than girls in mathematics. Just so, twentieth-century schools might have been expected to enhance children's knowledge, performance and employability at all levels of intelligence. Unfortunately, after 1945, as white-collar employment expanded, no very demanding standards were set for the educational and occupational achievements of high-IQ children. So long as such children moved into 'better' jobs than had their parents, most were satisfied, even though such upward mobility was bound to occur, regardless of educators' real achievements, as Western economies expanded (in response to re-building, American Marshall Aid and the new investments of the Cold War). Increasingly, syllabuses were adapted to include little more than what brighter children normally picked up from their parents and media exposure: e.g. the 'new maths' dispensed with rote learning and skill rehearsal and 'taught' only those principles that are grasped without any teaching at all by children of higher MA's.

Since the schools' apparent successes were not largely a matter of education, their remaining problem was not one of education either. Simply, the problem that remained was whether the IQ's of duller children could be boosted so as to give them, too, a chance in what was increasingly recognized as a competition for well-paid, congenial and secure employment - often in the public sector. IQ was thus thought important of itself, rather than in- its conjunction with relevant education; and much of the new education came to seem pointless unless *g* itself could somehow be raised. There was an important implication for

psychology: IQ itself would continue to interest educators only if it could be changed.

By the 1960's, there was awareness in the USA of the general success story of the scores of millions of 'starving and huddled' immigrants that had accepted (very generously, if with a little discretion - see Chapter 1) over a century. Yet there was awareness too of the failure of American blacks to catch up with whites economically since the century-old abolition of slavery - or since the fifty-year-old USArmy data had first suggested that blacks might have a special IQ-type problem.*(2)* Under the Democratic Presidents, Kennedy and Johnson, the USA was ready to embark on the biggest educational project of all time. 'Operation Head Start', the modernized and transatlantic version of kindergarten, aimed to improve the abilities and skills of pre-school children of low IQ so that they would not start school with a handicap. Over the next thirty years, thousand-billion-dollar sums would be poured into employing graduates to coach at-risk children from US inner city (i.e. predominantly black) areas in reasoning, comprehension and puzzle-solving tasks of the IQ type.

The early Head Start programmes produced only modest gains of 10-IQ-points - little more than is expected from the practice effect conferred by a first occasion of being tested; and even these gains were lost within two years. So *g* seemed to require closer study. Attracted to Head Start work was the idealistic psychologist from San Diego who was soon to become the leading expert on the validation of IQ tests (especially on the question of their possible biases), on their links to reaction times and on psychogenetic methods (see Chapters I, II and III). Arthur Jensen's reading and researches soon suggested that lower-IQ children would benefit only from teaching techniques that did not assume the possession of high levels of *g* . For duller children, Jensen recommended the use of highly structured, rote, visually aided, humour-assisted learning in which an instructor could be imitated and role models were conspicuously rewarded with applause. These were the very techniques that would soon be used with success by the popular TV programmes for pre-schoolers, Sesame Street and The Electric Company. Yet all this was at first rather shocking to liberal educators: they were unhappy with anything which involved pointing out, let alone criticising, failures (whether of children or TV characters), and also with the 'mindless' procedures of learning-by-heart. Invited by the Harvard Education Review to explain his positon, Jensen (1969) added fuel to the fire: he thought that the most likely (though unproven) cause of the increasingly familiar difficulties of black children under normal instruction methods would be a genetically low level of *g* . In particular, he was unimpressed by the likelihood that parental social class (SES) was a major cause of black children's problems: for example, Mexican children from poorer backgrounds did better than black children at Figure Copying (an excellent index of *g* in children - see Chapter 1, Figure I,1) (see Figure IV, 1).

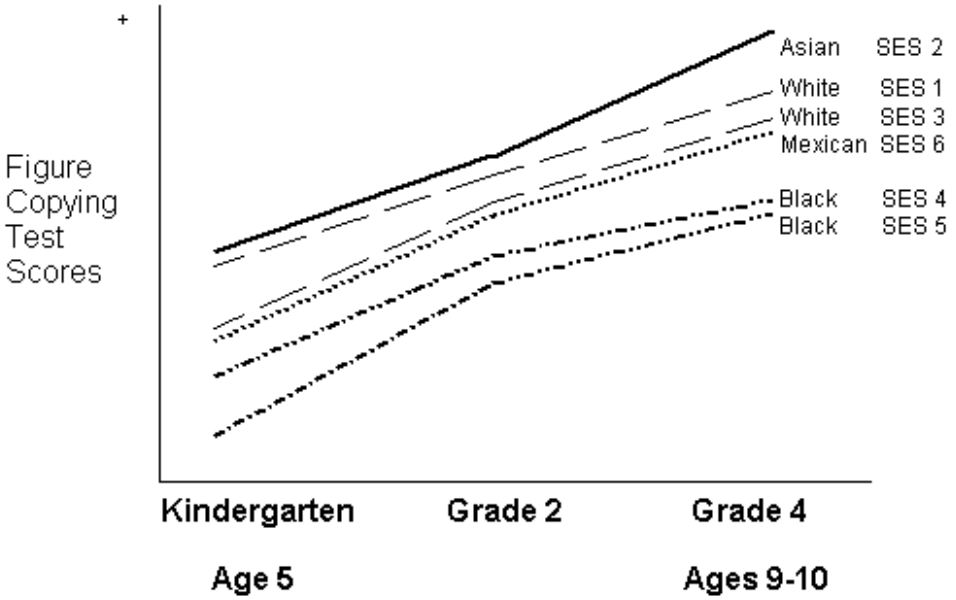


Figure IV,1: *g* levels of Californian children by age, ethnicity and social class.
Jensen (1980, pp. 663-4) and colleagues administered the Figure Copying Test (FCT; see Chapter I, Figure I,1) to over 10,000 children attending the same integrated schools in California. The children's ethnic groups were Chinese & Asian, Caucasian, Mexican-American (many from non-English-speaking homes) and Afro-American; and children in from these groups differed in the socioeconomic status (SES) of their homes, as shown on the right of the Figure. The range of the group means on FCT was almost two standard deviations (i.e. almost 30 IQ points) between Asian and black children. (The FCT is very highly related to readiness for primary school (Ilg & Ames, 1964).)

Jensen's classic, 100-page article would trigger a twenty-year crusade against him and his London School supporter, Hans Eysenck (see Chapter II). (Unlike most behaviourists, Eysenck accepted both the 'reality' of intelligence differences and their mainly biological origins; and he had already upset social scientists in Britain by claiming that Nationalists and Communists might have underlying psychological traits of illiberalism, insensitivity and spitefulness genetically in common.) Jensen and Eysenck's critics were further inflamed by the suggestion of the Nobel-prizewinner who invented the transistor that extra welfare payments might be awarded to lower-IQ women who had been sterilized (Shockley, 1975*(3)*) and that sex differences, like IQ differences, had biological bases (see Wilson, 1993).

Most educational experts agreed with Jensen and Eysenck that black IQ levels were low (for whatever reason) and that this deficiency helped to explain poor educational records and later lifestyles of crime and promiscuity. To recognize this deficiency (if not to publicize it) had remained tolerable while the racial difference in IQ seemed changeable - by the state providing black children with stimulation and experiences of the type standardly enjoyed by white children. Ready improvability of IQ was what Jensen doubted. His challenge was thus to the American dream. Up till then, those who wished to realize or bring about more equality could believe that 'compensatory' assistance to black people and their children would soon do the trick: this was the belief that Jensen implicitly contested. The USA's Declaration of Independence claimed that "all men are created equal"; but, for Jensen, doing the best for low-IQ children would require educators to work with, not to cut across the grain of unequal nature. The rage of frustrated idealists was soon to be witnessed worldwide: Jensen and Eysenck were treated as pariahs on the campuses of American, Australian and British universities. Jensen himself had supported the desegregation of American schools, and urged that children should be educated according to their individual IQ's - and not according to their race. Nevertheless, he was condemned by supposedly liberal-left students and the media as a 'racist' and subjected to hate mail and physical intimidation. While lecturing in the University of London, Eysenck was assaulted by young 'socialist workers' who had bussed to London especially for that purpose; and for many years both Jensen and Eysenck required police bodyguards. (For a full history of 'the Jensenist heresy' and the attempts to purge it from the universities of the West, see Pearson, 1996.)

However non-improvable intelligence itself may be, the faith of the behaviourist that practice makes

perfect continued to find a little support from scores on IQ tests. Gains continued to be reported on *g* tests, Piagetian conservation tests and allied cognitive-processing puzzles to which low-IQ pre-schoolers were repeatedly exposed in media-acclaimed efforts to boost intelligence. While Jensen and Eysenck were being pilloried for 'racism' and 'pseudo-science' (e.g. Hirsch, 1975), one project caused particular jubilation. Often called 'The Miracle in Milwaukee', its leaders were cock-a'-hoop by 1975: for the twenty black inner-city pre-schoolers exposed to the efforts of the team for five days a week for two years were showing gains of between 20 and 30 IQ points. George Albee's (1976) view was typical of enlightened educators: "I think the Milwaukee Project is very exciting. It challenges the notion that IQ is fixed. It has been criticized by the group around Jensen and Eysenck because it represents a threat to their position."

Yet do the improved scores of disadvantaged four-year-olds at IQ-type exercises lead to genuine improvements in the classroom? If self-confidence and expectations are important, wider gains should follow; and they should also follow in so far as IQ gains reflect increased 'knowledge' - often a help at even the most enlightened school. However, like a thermometer, an IQ test can be made to give a reading that no longer reflects what it is intended to measure; and Head Start programmes are like the cup of hot chocolate into which the hopeful truant slips his mother's health-checker. IQ scores can increase under unusual procedures; but wider and lasting educational gains can hardly be expected if no real and lasting gain has occurred in underlying mental ability - in the *g* factor. It was just such gains that eluded Head Start programmers. Even in the thorough and well-documented Abecedarian Project, gains on particular tests - whether the gains were great, or, more usually, small - were not reflected in IQ assessments on different tests at later ages, or in school skills. Such learning as the children had shown was 'shallow' and did not transfer (Reynolds, 1987). Most of the apparent improvements were the result of 'teaching the test' - of teaching the kinds of things required on IQ tests for children of a child's own CA.*(4)* The problem of was specially notable in children's reading ages: these usually correlate very strongly (at about .70) with MA's and IQ's, but they showed no substantial improvement from IQ-score-boosting. The exciting claims from Milwaukee remained unpublished in academic journals; and two of the Milwaukee team leaders were jailed and a third put on probation for fraudulent misuse of the research funds which their own extravagant promises had made it easy to attract. (Pine-log ranches in the forest were a special favourite with the researchers.) Nor had public expense been spared: the Milwaukee Project cost $14 million over fifteen years; and, counting all the professional and administrative personnel involved, the cost of such Head Start gains as were claimed was $23,000 per IQ-point gained per child (Spitz, 1986). Although the twenty-one experimental children had been reported as much as 32 IQ points ahead of controls when the intensive 51/2-year intervention stopped at age six, only a 10 point advantage remained by age fourteen (see Garber, 1988).

Twenty years after the beginning of the crusade against 'the Jensenist heresy', the game was up. Using data from the US Department of Health and Human Services on the seventy-two major programmes to have been researched, two British researchers who had themselves been instrumental in exposing Burt's roguery accepted that the 9-10 IQ-point gains typically washed out within one year and that "by the end of the second year, there are no educationally meaningful differences on any of the measures" (Clarke & Clarke 1986, 1989) The Clarkes concluded that "....preschool intervention programmes cannot by themselves be expected to have long-term dramatic effects...." Nor had imitators been more successful. In the British Isles, none of the three substantial Head Start researches had delivered worthwhile gains. For example, following an intensive two-year programme and annual testing for three-year-olds in a deprived Dublin suburb (and involving children's parents), experimental children, by age eight, were merely seven IQ points higher than untreated control children and showed no distinctive educational gains (Kellaghan, 1977).

More spectacularly, in Israel, the grandfatherly, cherubic Reuven Feuerstein continued to attribute minority children's educational problems to a lack of "mediated learning experiences." Feuerstein supposed that minority parents defer unduly to the "dominant culture" and thus refrain from transmitting what they know best - the culture in which they themselves grew up. According to this account, many ordinary remedial efforts by white psychologists and teachers would be of little help to black children - as indeed had happened in Head Start.

However, Feuerstein's ingenious proposal, his outright belief that "the human organism is modifiable at all ages and stages of intellectual development", and his therapy of "instrumental enrichment" (Feuerstein, 1980) are still of uncertain relevance to raising *g* itself. His own enthusiasm and sensitivity certainly helped non-Ashkenaze Jewish children with little educational background to adapt to Israel. Yet no other minorities have the15 IQ-point disadvantage in *g* of black people in America; low scoring by other

American minorities such as Indians, Hispanics and the deaf is mainly on tests of the verbal, crystallized type - reflecting a language handicap more than a problem with fluid intelligence; Feuerstein, too, engages in 'teaching the test' (Reynolds, 1987); and Feuerstein's own treatment results have not replicated (Frisby & Braden, 1992; Braden, 1994). The Local Education Authority of the English county of Somerset was keen enough to involve thirty teachers in trying out instrumental enrichment on a thousand low-achieving pupils over three years; but researchers found little evidence of any positive effect on intelligence and no gains at all on reading, mathematics or study skills (Blagg, 1991). Twenty years on, and after vast expenditures of public monies, Jensen had been vindicated: just as he had written a quarter-of-a-century earlier (Jensen, 1969, p.2), "Compensatory education has been tried and apparently it has failed... In other fields, when bridges do not stand, when aircraft do not fly....one begins to question the basic assumptions, principles, theories and hypotheses that guide one's efforts." Head Start had proved to have a modestly improving effect on the delinquency rates of children who had received this preschool exposure to kindly middle class adults (Zigler et al., 1992); but its impact on intelligence and educational achievements had proved vanishingly slight. Only the sheer scale of the public funding of Head Start had fulfilled the wildest dreams of its supporters.

As they gradually came to realize the limitations of Head Start, crusaders against the 'Jensenist heresy' found that three lines of dignified retreat had been blocked.

1. IQ tests were just as fair and valid for use with black children and adults as with anyone else (see Chapter I). In particular, the tests were markedly fairer than life itself (Jensen, 1980; Blinkhorn, 1985): if the tests erred, it was in predicting slightly more achievement and productivity than was actually forthcoming when black workers of particular IQ levels were selected and hired.

2. In the 1980's, it had emerged that low IQ's were not generally characteristic of racial and ethnic groups that had been surrendered by their native communities to hard labour and serious discrimination in far-off lands. Jewish migrants from anti-Semitic Europe and the Chinese and Japanese brought as indentured labour to North America in the nineteenth century are examples of groups whose children enjoyed normal or above-average IQ's despite growing up as readily identifiable minorities amidst blatant ethnic prejudice - and, for American Japanese, outright wartime dispossession for which compensation was not awarded till 1990 (Vernon, 1982; Lynn, 1992b). Likewise in Britain, although Pakistani immigrants suffer prejudice and maintain a language, religion and moral code that distance them from their British hosts, their children have always tested as being of normal intelligence once they have learned English, and they slightly out-perform English children educationally by mid-adolescence (see Mackintosh and Mascie-Taylor, 1985; Brand, 1987c). 3. Almost the full Afro-American deficit, of some 15 IQ points, could be detected in children as young as three years, born to black mothers who were themselves college-educated, married and had no pregnancy complications or health problems (Montie & Fagan, 1988). Medically and socially matched, these young black children had a mean IQ of 91 and the white children tested at 104. The matching ruled out explanations of the black deficit in terms of rearing by single-parent mothers in the squalid conditions of welfare-dependency, criminality, male intimidation and drug abuse that are certainly all too often the lot of black children. At the same time, what Jensen had long taken to be the best-established IQ-boosting exercise of all had been tried without achieving any special purchase on the black deficit: adoption of black infants into white middle class homes had yielded its usual 8-point IQ gain plus some narrowing of the gap between black and white adoptees at age 7; but, by 17, the black youngsters lagged the white by the usual 12-15 IQ points (Weinberg et al., 1992; Lynn, 1994).

Altogether, Operation Head Start was over (except as an expensive way of producing minor improvements in delinquency rates). Black children's lower IQ's persisted even when black homes were matched to those of whites in terms of income, years of education, marital stability and health, or when children grew up in professionally selected white homes; blacks did not perform conspicuously better in any of the countries or North American cities run by blacks themselves - indeed, they usually performed much worse, though testing was patchy and subject to the interpretative problems that arise when comparing people having different countries and languages; and there was mounting evidence that the Japanese children, whether growing up in their war-torn and subjugated homeland or in North America had IQ levels that actually exceeded those of whites (Lynn, 1982; Vernon, 1982; Herrnstein & Murray, 1994; Burnham, 1994). The American dream of human improvability was now becoming a nightmare, for the only way to equalize black people in outcomes (and not just in opportunities) was to compel 'affirmative action' by colleges and employers. To legislate and enforce reverse racism would necessarily

create bitterness - especially amongst Asians(5) and whites of mediocre abilities who were thus deprived altogether of college places and middle-class career opportunities by still less qualified black candidates. This resentment would be translated into political action if ever the US economy faltered. Inevitably, there developed gun-toting and bomb-making militias that exhibited a paranoid hostility to all Federal government and sought the freedom to deal with crime (50% of it being by blacks in the USA) in terms of local rather than nationwide conventions. Nowhere else in the West were modern liberal and welfare-state values so starkly dependent for their recognition on the local success of capitalism. However, a powerful narcotic was on its way.

By the 1980's, the sheer weight of evidence was beginning to tell on the opponents of *g* . Especially, it was noticeable that the main scholarly efforts to rid the world of talk of heritable *g* now came from non-psychologists (notably Stephen J. Gould (1981) at Harvard, Steve Rose (Rose et al., 1984) at Britain's Open University and Maurice Schiff in Paris (Schiff & Lewontin, 1986)).

Yet some were braver. Apparently *g* itself would not break up into multiple, uncorrelated components; perhaps it had correlates in mental intake speed; clearly it was mainly genetic in origin, and its average measured level seemed bound to remain low in one of the major racial groups despite unprecedented public expenditures. But there was another line of argument that could be tried - a finger that could be put in the dike. Perhaps *g* could at least be pronounced somehow 'irrelevant' to real-life achievements or at least enjoyments? If the enlightened would only step back from what might, after all, be a twentieth century obsession with mass-literacy and numeracy, perhaps *g* could be seen as actually of no greater general importance than are ability differences in boxing, rowing or table-tennis? If so, educational problems could still be left to liberal educators to handle in line with modern conventions: they would simply treat all children alike, encourage them for all their attainments and efforts, and simply steer clear of the understanding of *g* that has accumulated through the twentieth century. There was once a time when egalitarians argued for environmental causation of IQ and troubled to investigate by experiment whether it could be raised: egalitarians had not invariably taken the position of asserting that there simply must be many different types of intelligence and complex interaction effects that defy any simple view. Yet there was an alternative. It had once been a criticism of *g* that it might be a concept too closely related to the requirements of the military-industrial complex and the capitalist system. Yet perhaps the very opposite might be true? At least, it might be easier on the nerves to believe. At least, face might be save by behaving publicly as if *g* itself were simply of little general consequence. By 1990, four versions of this thesis were on offer from modern academia, querying *g* 's relevance along the following lines.

1. (i) The possible irrelevance of *g* to explaining the skills of savants. The first way of disputing *g* 's psychotelic importance has been to talk up the achievements of those children and adults once called idiot savants, but today often diagnosed as suffering from the reality-curtailing disorder of autism which especially impairs social intelligence.(6) Autistic people test at around IQ 55 (though with an unusually wide range of scores) and are quite incapable of earning a living; but some, the savants, have remarkable gifts for music, drawing, calendrical calculation, finding prime numbers and learning bus timetables. (Such knowledge of timetables is admittedly purely numerical and without spatial reference. - It would be of little assistance to helping anyone trying to plan how to travel from one location to another.) So there are some unusual abilities that do not depend on *g* . However, other special human features like language, bipedalism (enabling long-distance carrying of heavy weights) and a marked sex role division of labour equally distinguish homo sapiens without depending on *g* .(7) (See Anderson (1992) for major ability 'modules', like the sense of balance; and see Cosmides & Tooby (1992) for more specific abilities like that of detecting whether a sexual partner is cheating.) The existence of autists having special, non-g-dependent 'gifts' makes no new point of wider significance: there are many special abilities that have rather little relation to *g* or indeed to anything else - as Spearman had first noted of the ability to draw. Perhaps such abilities develop more easily when they are not in competition with other abilities for access to processing resources; but however they arise, savant gifts are uncommon, often highly practised and have so far thrown no light on how normal people calculate or play music. Lastly, autists gifts have no functional significance when unassisted by *g* . - The world's most remarkable known mnemonist, for example, combines her gift with an IQ that puts her in the top 0.1% of autists in terms of *g* (see Jensen, 1993). Autists' own major problem - of having no 'theory of mind', i.e. of finding it hard to recognize that they live in a world that is composed partly of people who have feelings, beliefs and intentions - is itself an interesting specific disturbance, presumably in an innate

mechanism. Even so, the extent of autists' social difficulties is well predicted (r = .50) quite simply by the degree to which they fall below average in plain IQ (Eisenmater & Prior, 1991); and autistic symptoms are seen in 80% of children in the IQ range 0-19 (Frith, 1993). So *g* is a major predictor of both the skills and the handicaps of autism.

2. (ii) The possible irrelevance of *g* to understanding learned skills. Some critics of *g* 's importance have impressed each other by claiming to find skills that are unrelated to intelligence levels in normal people. Thus Ceci & Liker (1986) claimed that regular gamblers' skills at estimating the odds that bookmakers will set on race-horses are not predictable from gamblers' IQ's. Yet this research involved comparison of gamblers who seemed to use a mathematically sophisticated model with track-knowledgeable but mathematically unsophisticated subjects, and re-analysis found different effects in the two groups: the brighter unsophisticates tended to do poorly (perhaps reflecting lack of interest in the experimental task), whereas, among the sophisticates, there was actually a true correlation of +.59 between success at odds-estimation and IQ (Detterman & Spry, 1988). Anyway, apart from the methodological limitations of this study, to appeal to the skills of inveterate gamblers is strange: these 'skills' require half a lifetime of practice and still make gamblers no reliable profit. Stephen Ceci (1991) has further claimed that mental abilities are only collections of skills that can be taught, and that IQ differences are simply caused by differences in time spent at school. However, this testimony to John Watson's inspiration has not been accompanied by any general evidence of restricted IQ ranges in children who have similar lengths of exposure to education. Probably the lower-IQ children of 1930's North America in studies reviewed by Ceci took more time off school because they were needed on their fathers' farms or did not like repeatedly failing at school in competition with higher-IQ classmates. - The early non-environmentalist theory of Yerkes et al. (1921) (Chapter 1) would seem more likely in view of Ceci's failure to deliver the required demonstration from half a century of data. Krechevsky and Gardner (1994, p.287) may claim that IQ's non-academic correlates are "unimpressive"; but they fail to consider the unreliability of many of the laboratory, school and workplace performances that IQ does predict at a level that far exceeds the correlations achieved elsewhere in the social sciences.

3. (iii) The possible irrelevance of *g* in view of generational changes. - Are there sudden, "massive" yet remarkably inconsequential secular changes in "mere problem-solving ability"? A third line of attack on *g* 's importance has focussed more closely on the best established racial difference in *g* - that black people score markedly lower than whites, who in turn, despite their numerous economic advantages after 1945, score somewhat lower than Asians. In the 1980's a New Zealand athlete and political scientist, James Flynn (who had been radicalized when seeing police shoot students during rioting in 1968 at Kent state University, USA) became Jensen's sternest yet most scholarly critic. At first, Flynn (1980) granted the case for *g* 's existence and heritability, admitted that the 'Factor X' causing the 15-point black-white difference in *g* had still to be found, and only stopped short of saying that no environmental explanation for the racial difference would ever be found. However, Flynn's continued involvement with IQ test data soon yielded him a firmer environmentalism: apparently, group differences in *g* might be affected by previously unidentified factors that had been at work through the middle of the twentieth century. Flynn (1987) published IQ test results from batches of military conscripts who had been tested over the years in seventeen economically advanced countries. Levels of tested IQ-type intelligence had been rising "massively", said Flynn, by some 6 IQ points per decade since at least 1950. In fact, rises in IQ-type intelligence had first been noticed in America and Britain of the 1940's (e.g. Cattell, 1949), and then in other countries by the late 1960's (Koppen-Thulesius & Teichmann, 1972). However, Flynn's observations seemed to him of special interest in establishing two points. (1) *g* could show "massive" changes without anyone noticing very much - and even while creativity was actually falling by some criteria. In particular, Flynn observed that, despite a big IQ rise among Dutch conscripts, fewer patents for new inventions were being taken out in Holland in 1980 than in 1950; that US students' Scholastic Aptitude Test (SAT) scores had been falling since the mid-1960s; and that modern art continued its sad decline into meaninglessness. Possibly *g* did not really matter after all. (2) Peoples like the Dutch and the French had changed their *g* levels quickly, so US Afro-Americans might one day do the same.

   There are SEVEN PROBLEMS [a - *g,* below] for Flynn's important thesis regarding the IQ-type rise and its interpretation. (For the arguments between Brand and Flynn, see Brand (1995a) and Flynn (1995).)

1. (a) Gains from reduced reluctance to guess. Flynn's evidence is drawn largely from short, timed, multiple-choice, group-administered tests of IQ on which there is no correction for guessing. Scores on such tests may have improved since 1945 not just because of rising *g* levels but because of modern educators' encouragements to children to avoid 'obsessional' accuracy and 'pedantic' attention to detail. Being composed of different sections, each requiring use of different principles (e.g. series completion, analogies, oddity), most group tests effectively penalize testees who strive for accuracy. Such testees spend valuable time trying to be quite sure they are giving correct answers - rather than making use of guesswork (see Figure IV,2).

Suppose that, in an attempt to test a mixture of numerical reasoning ability and basic arithmetical skill, you were asked to answer as many of the following questions as you could in the next three minutes.

Question						Your Number Answer ⇓
	HOW SHOULD THE FOLLOWING SERIES CONTINUE?					
1.	5	10	15	20	**?**	
2.	3	7	12	18	**?**	
3.	2	5	14	41	**?**	*{x3, -1}*
4.	3	4	11	116	**?**	*{square, -5}*
	FIND THE NUMBER THAT WOULD MAKE THE SECOND TRIO OF NUMBERS RESEMBLE THE FIRST.					
5.	6 : 2 : 12			9 : 3 : **?**		
6.	5 : 7 : 40			6 : **?** : 53		*{multiply first two, +5}*
7.	4 : 1 : 25			**?** : 2 : 64		*{add first two, square}*
8.	3 : 5 : 7			23 : **?** : 29		*{successive primes}*
	WHICH NUMBER IN EACH ROW IS UNLIKE ALL THE OTHERS?					
9.	10	30	90	61	40	
10.	49	63	84	20	14	*{most divisible by 7}*
11.	5	37	17	26	12	*{most a square plus one}*
12.	11	17	25	46	73	*{most a prime minus 6}*

Figure IV, 2: The speed/accuracy trade-off in testing: When guessing pays.
Suppose that, in an attempt to test a mixture of numerical reasoning and basic arithmetic skill, you were asked to answer as many of the questions as you could in three minutes. Suppose the same mark were awarded for each item and no correction were made for guessing (by subtracting the number of incorrect answers given). The high-scoring strategy for a testee under a time limit would be to avoid being delayed by the harder items at the end of each section when easier items follow: i.e. to avoid becoming stuck on items 3, 4, 7 and 8. A workable strategy would occur quite naturally to some testees when encountering harder items: to guess, to proceed to the easier items (5, 6, 9, 10), and to return later to check the guesses on the harder items if time still allowed.

Time spent labouring on harder questions at the end of the earlier sections of multiple choice tests would often be better spent on the much easier, but equally weighted questions that lie ahead at the beginning of new sections. The correct strategy for testees is: 'When in doubt, guess'. By contrast with such 'group' tests, full, individually administered Wechsler testing (where questions increase steadily in difficulty and where there is no trade-off between time available for the different subtests) shows much less inter-generational change in intelligence levels. For example, the Wechsler scores of Scottish primary school children showed an increase of only 2 IQ-points from 1964 to 1983 - even though, in accordance with the big cultural changes over the period, the 1983 children were significantly less likely to know what 'a belfry' was and more likely to be able to define 'alcohol' (Brand et al., 1989). The mid-twentieth-century intelligence rise is certainly less than Flynn has sometimes suggested; and*(8)* he himself has settled for Wechsler gains of 3 IQ points per decade. However, the gains on Verbal tests, of around 2 points per decade, are considerably less than the gains of

7 points on Performance tests (all of which involve score credits for speedier solutions) (Lynn & Pagliari, 1994): so even the Wechsler gains are not due wholly to a rise in levels of *g* .

2. (b) Gains not unimportant, just obscured. Flynn is quite right that university professors have not been seen 'dancing in the streets' at their students' new-found comprehension and creativity. However, the enormous post-War expansion of university intakes (Hobsbawm, 1994) would have been likely to reduce the average intelligence of students from around IQ 145 in 1950 to a modest rise-corrected IQ of perhaps 115 today - lower than used to obtain in the average British grammar school of the past. The population IQ rise and greater selectivity by IQ-type criteria (rather than by the advanced learning once fostered in private and grammar schools) merely served to keep student IQ levels at around the pre-rise level of 125 that used to obtain in good universities of the 1960's. For example, scores on Raven's Advanced Progressive Matrices by students at the University of Adelaide showed no change from 1967 to 1992 (Con Stough, personal communication).

3. (c) No true decline in patenting. The decline in patenting (suggesting the uselessness of the supposed *g* gains and thus of *g* itself) is not in fact general. Flynn's observation was drawn from the Dutch Patent Office in Amsterdam and he neglected that, from 1960, inventors in all European countries were increasingly using the Europe-wide patenting facilities available in Munich.

4. (d) A real 'dumbing down' of education. The US decline in the high-level scholastic attainments and aptitudes measured by SAT will equally reflect the lowering of educational standards, despite rising student abilities. Herrnstein & Murray (1994) document the case for this in the USA, as do Green & Steedman (1993) for Britain (see below). (In Britain , state scholarship examinations, Oxbridge entrance exams and Oxbridge scholarship exams were all abolished between 1960 and 1995 - thus decreasing the motivation of secondary schools to teach pupils to a high academic level and to employ suitably educated staff.)

5. (e) Why expect further Afro-American gains? The secular *g* rise - or part of it - was presumably due to the massive twentieth-century improvements in affluence, in diet, in health and hygiene, and in obstetric and gynaecological practice. Yet, if such improvement-led *g* rises have occurred in the past, black people in the USA - the world's best-fed country - will already have enjoyed the *g* boost along with whites. Big nutritional improvements will be more readily achieved in people who, because of poverty or ignorance of proper nutrition have especially poor diets in the first place; so any black 'catching up' that was possible should have been accomplished already in the USA. Some highly publicized experiments have claimed IQ-boosting by vitamin and mineral supplements in schoolchildren on normal diets. However, these gains have occurred only on some tests rather than others; the particular tests showing gains were not especially the tests of fluid intelligence on which researchers had expected gains (Blinkhorn, 1991); and the gains were mainly slight and bore no relation to dosage (see Peritz, 1994*(9)*). Furthermore, wide uptake of even the most obviously improving advices about nutrition cannot be guaranteed - as with advice that mothers should not smoke or take other drugs. The first good evidence from controlled experiment is now available that breast milk is causal to the higher IQ' s of breast-fed babies (Lucas et al., 1992; Lanting et al., 1994): premature babies in Cambridge and Sheffield, supplied with their mother's milk by tube feeding, had IQ's at 8 years that were 10 points higher than those of babies whose mothers had intended to breast feed but could not do so; and breast-fed babies had only half the rate of neurological abnormalities by age 9 in a Dutch sample where the breast-feeding mothers were only a little higher in the frequency of being 'middle class' (97% vs 81%) and of having completed secondary education (94% vs 87%).*(10)* However, beyond the world of research, mothers of lower educational level and socio-economic status are will not normally breast-feed despite campaigns by health and welfare staff to shift their preferences; and whether breast-feeding could be markedly increased among black women is unknown. There are some frankly irresponsible claims that nicotine improves concentration and intelligence test performance (O'Hare, 1995); however, the benefits of nicotine have been reported only in smokers - so it probably serves only to reduce the familiar withdrawal symptoms of addiction, and not to boost IQ in non-addicts. Overall, Flynn's argument makes the mistake of which hereditarians are often accused: Flynn assumes that heritability implies non-plasticity, and he therefore concludes that generational plasticity limits heritability estimates and implicates environmental factors in accounting for

low black IQ. However, an environmental cause for a between-generation change may be entirely compatible with within-generation differences being largely genetic - as Lionel Penrose first pointed out in 1946 (Evans & Waites, 1981, p.71). Mean levels of features that are heritable within one generation can change by the occurrence of environmental values that were not in operation previously; and heritability itself may be lowered if these environmental changes occur for some individuals but not for others. Conversely, an environmental change can affect all individuals yet leave heritabilities and group differences intact - until the next novel environmental shift. Such between-generation environmental change is what seems to have happened in the case of the secular rises in height and in *g* levels. There is no clear implication for whether black IQ levels might be especially boosted in future. It is hard to imagine that average dietary standards could again be improved as much as happened in the century from 1870: to that extent further IQ-type gains would seem unlikely. Finally, for any treatment to arrive that boosted black IQ without boosting white IQ would reveal a more remarkable racial difference than anything that has so far been suspected.

6. (f) Within generations, IQ's importance is readily demonstrable. Flynn's claim that IQ tests measure "mere problem solving ability", is strange IN FIVE WAYS. (Emphasizing the distinction that he wishes to draw between 'mere problem solving ability' and 'intelligence', Flynn (1987) maintains that IQ is only "a correlate with weak causal links to intelligence." However, Flynn does not spell out what the other ingredients of intelligence itself might be.)

    1. (1) Many people would take pride in being thought to have good 'general problem solving ability'; and many IQ testers would be perfectly content if problem-solving were indeed what their tests had been deemed to measure.

    2. (2) IQ is just as important and predictive for children as their early attainments (as assessed by teachers or in exams). This was first established in work undertaken for the Scottish Council for Research in Education (McClelland, 1942); and "IQ rises in predictive value relative to other measures as years go on" (p.77). In a long-term follow-up of a random sample of state-school five-year-olds on the Isle of Wight, IQ correlated strongly (at .50) with children's later educational attainments, when they were fifteen. Such prediction for individuals across ten supposedly formative years is unparalleled in social science. Notions of IQ's 'unimportance' in education (e.g. Eckberg, 1981) typically derive from studies in which IQ range is severely restricted: for example a correlation of .50 in the general population will be only .35 in either the top or the bottom half of the population (Detterman, 1993). IQ has seldom correlated better than .30 with college grades; but this is because of the relatively strict admission criteria for university students of the past, and because students self-select themselves by ability level for particular colleges and courses and thus restrict IQ ranges in the present. Anyhow, college exams are often incapable of correlating with anything very much because the correlations between their own components (i.e. their own internal reliabilities) are not checked by college authorities (for fear of what will be revealed about the validity of modern assessment procedures) and are often low.*(11)*

    3. (3)There is nothing 'mere' about the correlates of IQ today. IQ is substantially related to: athletic ability, choice of marital partner, dietary preferences, liberalism and anti-authoritarianism of social attitudes, achieved socio-economic status (by age 40), law-abidingness, middle class values, marksmanship (especially with a tank gun), altruism, good health, likely psychiatric illnesses and a better sense of humour (Gordon, 1986; Brand, 1987d; Egan, 1989; Seligman, 1992; Herrnstein & Murray, 1994).

        Using a representative sample of 11, 878 young Americans studied from adolescence to age 30, the late Harvard professor of psychology, Richard Herrnstein, and the economist, Charles Murray, found strong effects in the bottom 10% of the IQ distribution. At around IQ 75, young Americans (regardless of race or class-of-origin) are much more likely to be unemployed, to be receiving welfare, to be living in a correctional facility (males) or living as a single parent (females). Among single-parent mothers, the low IQ were far more likely to be rearing their children in poverty than

were the high-IQ (70% vs 10%). Quite generally, the effect of low IQ on lifestyles is much greater than that of similarly low levels*(12)* of parental socio-economic status or of young adults' own current incomes. Herrnstein and Murray further believe that the USA is becoming increasingly 'stratified' according to IQ - with a high IQ being increasingly in demand for top jobs and increasingly an objective of middle-class socialization procedures. (Genetic-environmental covariation could have increased if higher-IQ parents now provide especially IQ-enriching early environments for children whose genes already predispose them to an above-average IQ - see Chapter III.)*(13)* The importance of perceived intelligence in important personal life choices accords with the above: across thirty-seven cultures, people show a strong preference for intelligence in their potential spouse (Buss, 1989).

4. (4) Occupational psychologists have lately received a definite answer to their own long-standing question of how to predict occupational productivity in adulthood. In a review of work involving thousands of jobs and professions in the USA, and hundreds of testing procedures, it was the mental tests which correlated best amongst themselves (i.e. indexing g) that turned out to be the main predictors of occupational success and income (Hunter & Hunter, 1984; Schmidt et al., 1992). Even quite everyday skills require g: for example, Jensen found US Army data showing that, though anyone with a little training can make a 'jelly roll' (jam sandwich) to US Army specifications, it is higher-g cooks who make the better scrambled eggs. Just about the only white-collar occupation for which *g* is not in demand is that of being a salesman: evidently there are some 'social skills' that are not g-related, even if they may not be admired by all. Beyond what *g* supplies, it is usually only a few specific packages of skills - e.g. typing speed and accuracy - that are relevant to job success. Upward 'intergenerational mobility' (advancing beyond the socio-economic position of one's own father) in the USA is strongly predicted only by IQ (Waller, 1971*(14)*; Touhey, 1972; Herrnstein & Murray, 1994). In the UK, literally no large scale work involving IQ is undertaken in the countless 'surveys' by social scientists. Still, such modern work as has been conducted shows children's intelligence (and other 'personal' factors) to provide some forecast of occupational status even by the early age of 23; by contrast the father's job, social status and type of home provided today predict little (Cassidy & Lynn, 1991). (Even such modest predictions as might be made from parental SES will themselves reflect *g* differences transmitted to children - Brand, 1987c; Bouchard, 1995 .

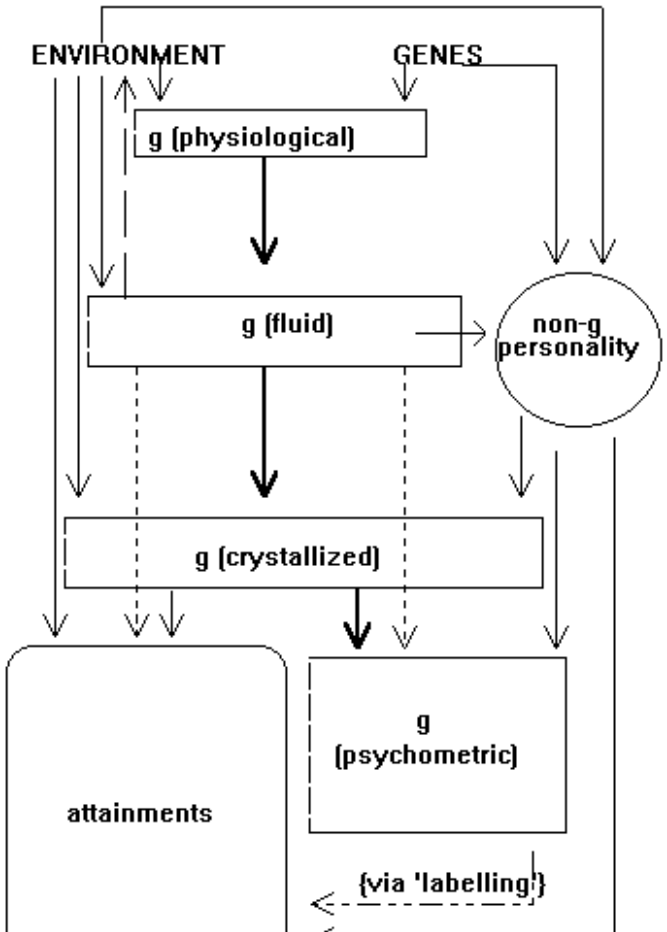
5. (5) If IQ is dismissed as an unimportant variable, how can Flynn explain the educational progress of American Orientals (e.g. Humphreys, 1988) and their massive over-representation in the better universities and in the professions? Flynn answers that Oriental success is due to achievement motivation and hard work.*(15)* This view would be quite unacceptable to the West's educationists, but that alone should not commend it. In fact, the more adequate modern samples of Asian people in North America and Japan indicate they score on conventional group-administered IQ tests at around 105, but higher on non-verbal tests (Lynn, 1993; and see Figure IV, 1). Moreover, since Orientals are introverted and conscientious, they are actually somewhat handicapped on the many group tests of IQ that require speed of answering rather than accuracy. Probably Oriental IQ is around 110 (though still higher in childhood, at the period when the complexities of Asian languages need to be learned - in several different forms - by growing children). In any case, by most accounts Japanese university students and businessmen do not work particularly hard. They put in long hours, but appearing deferential and being a team player are primary concerns - as they doubtless were when Britain was a great manufacturing nation. Flynn's own effort to play down the importance of *g* to Oriental success is nothing more than a quaint diversion: it has never yet been shown that hard work is a major cause of economic success, and the case of the Japanese does not change matters.

7. (g) Flynn's arguments range from the self-contradictory to the unparsimonious. Flynn's two points regarding IQ's unimportance and the hoped-for impermanence of the black-white difference do not sit comfortably together. If IQ were "mere problem solving ability", there would presumably be little educational or economic gain from Afro-Americans coming to experience the inter-generational IQ rise (assuming they have not experienced it in full

already). Moreover, what could be the explanation of continued Afro-American educational or economic lags if the black-white IQ difference has dematerialized into 'mere problem solving ability'? Is Flynn suggesting that black workers are lazy? It is unparsimonious to hold that low black IQ and low black achievements require two separate explanations. (Likewise, it is unparsimonious to suppose that low IQ in black people has different causes from low IQ in whites. Once again, this would make blacks still more of a special race: they would be more dissimilar from other 'disadvantaged' minorities than London School theorists have ever entertained when attributing black difficulties simply to *g* .) Although Flynn has the distinction of being the only political scientist since Adam Smith to make a contribution to psychology, many of his ingenious arguments now serve only to draw a veil over his never having found the environmental 'Factor X' for which he started looking twenty years ago.

4. (iv) The supposed irrelevance of *g* to explaining anything at all in psychology? A putatively philosophical approach is adopted by some critics of *g* 's importance. Are IQ's after all not 'mere numbers'? Surely such IQ numbers cannot themselves explain anything or be of any importance except indirectly as a crude reflection of countless more subtle processes that have yet to be understood? The criticism that IQ's can be dismissed as mere numbers that are of no causal or real significance in their own right was advanced by Professor M.J.A.Howe (of the University of Exeter) and found favour with the editors of the prestigious medical journal, The Lancet (see Brand et al. ,1991). Incisive as Howe's criticism may seem, however, a version of it has always been intrinsic to the conceptions of the London School. Tested IQ itself has never been viewed by the followers of Spearman as more than a surface phenomenon: they have always presumed that IQ test scores themselves are only more-or-less faithful reflections of deeper, underlying processes and realities. Figure IV,3 represents the classical London School position: psychometric *g* (gpm) is just one surface outcrop of a causal play of several distinguishable influences. From the material forces that set up nervous-system differences in what might be called 'physiological *g* ' (gph), gf differences emerge that express themselves, eventually, in gc, educational interests, attainments of all kinds and also in performance on IQ and other cognitive tests (gpm).

Figure IV,3: Diagram representing the more commonly ventured explanations of how individual differences in intelligence and attainment arise.
{The diagram highlights, *via* ↓, the 'spinal column' of explanations that involve *g* as a causal variable: g [physiological] → g [fluid] → g [crystallized] → g [psychometric].}

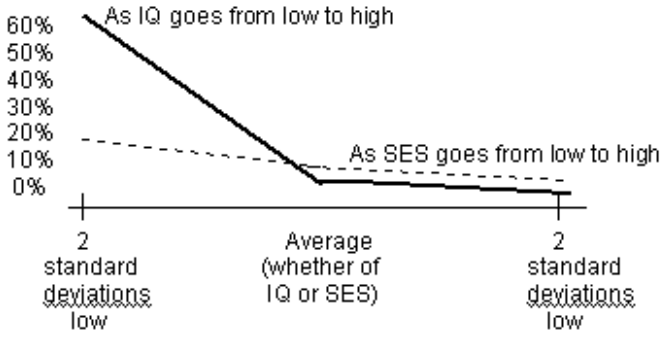


The theoretical approach developed by the London School - now including outposts in the universities of Auckland, Adelaide, Berkeley, Brisbane, Edinburgh and Perth (Western Australia) - posits precisely a real, underlying, essential variable of *g* . Especially in its fluid form, *g* plays out (sometimes in interaction and covariance with other life features) into numerous human differences and test scores: it is envisaged as central to many effects that may seem superficially environmental. No-one but a surviving devotee of 'labelling theory' (see Chapter 1) would suppose that an IQ score is of itself an important cause of anything. To issue the causal inefficacy of IQ scores in criticism of the London School shows an unwillingness to read what Jensen and Eysenck have actually written.

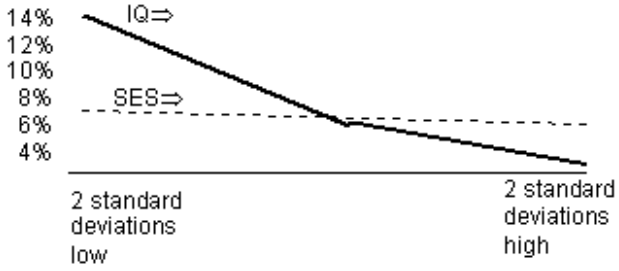
Is there possibly some hidden strength to Howe's argument? A modification of it would be to assert that *g* itself cannot be causal since, except in so far as it is a number, no-one knows what it really is. However, this would merely be to revive the arguments addressed in Chapter I. The critic who cannot accept the case for *g* 's existence offered in Chapters I and II should consider whether any conceivable evidence could attest *g* 's reality. - If not, the philosophical problems belong to the critic rather than to *g* . Still, perhaps *g* is just a vague concept that it is up to professionals, and not the critic, to define? Perhaps the critic can hide behind the coat-tails of the layman who merely requires the experts to do their own proper job? Yet 'electricity' and 'gravity' are precisely like *g* as far as lay users are concerned. Like these concepts, *g* has a clear definition within its own field, psychometric psychology, as 'that which most mental tests measure'. The layman's inability to say much about electricity and gravity may express many attitudes to science - ranging from boundless indifference to perfect confidence; but it does not constitute a challenge to the causal force of these variables. To withhold causal status from *g* because it is 'undefined' is not to do battle but only to opt out of the argument: it shows a head well and truly in the sand - probably insisting also that *g* can only be a mathematical abstraction just because it is measurable (unlike several of the personality influences that Howe has mooted as explaining the IT/IQ correlations of Chapter III).

Such are the ways of continuing to pretend that people are essentially equal - and not just morally equally in their entitlement to opportunities. Radical inequalities in *g* are persistent and important to human social hierarchy and division of labour - and thus to society itself in its dynamic interplay of mutual need and mutual regard. Nor, apparently, could equalization be achieved by a sacrifice of liberty - and fraternity would be a further casualty of such a swap. To deny the importance of intelligence might ease the pain of the failures of Head Start programmes, but reality will keep on breaking through. The decade in which James Flynn provided the major talking point for utopian hopefuls was one in which Herrnstein and Murray (1994) reported the first mass-scale, representative study in which IQ and SES were tested against each other for their ability to predict important lifestyle outcomes in adulthood: the thorough testing of adolescents that was enabled by cash payments to testees from the US Army demonstrated the full extent of the explanatory power of IQ differences. Leon Kamin (1995) has tried to explain why Herrnstein and Murray found little effect of SES on its own: Kamin's idea is that no environmentalist would expect SES to operate other than via IQ. This is itself a startling concession by a devotee of SES to the centrality of IQ in human affairs. Yet Kamin is still leaving most of the causal story untold. For the fact is that IQ still generates big differences even amongst young adults from identical SES backgrounds: as Kamin suggests, SES may indeed be uninfluential apart from IQ; yet IQ demonstrably important even without any involvement of SES (especially across the lower part of the IQ range, from 75 to 100). Figures IV, 4, 5 and 6 illustrate the loci and strengths of effect for IQ's influence that were found by Herrnstein &Murray.

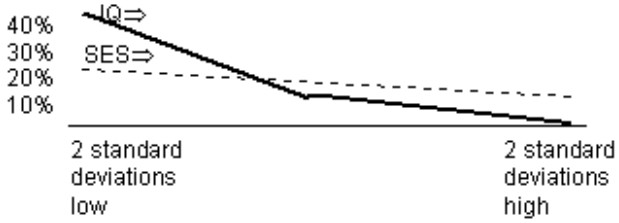
Figures IV, 4, 5 and 6. How important is IQ? How well does IQ in adolescence predict later lifestyle variables (up till around age 30)? How does IQ's forecasting power compare to that of parental SOCIO-ECONOMIC STATUS (SES)?
R.Herrnstein & C.Murray (1994, *The Bell Curve*, New York, Free Press) analysed data on 13,000 representative young adults in a long-term study by the US Departments of Labor and Defense. Subjects had been paid while adolescent to attend and participate in a full battery of IQ-type tests.
Regression lines below for IQ and SES show their influences *separately*: they are calculated with the other variable (SES, IQ and also age) *partialled out*.



IV, 5: *Probability (in white males) of being unemployed for a month or more*



IV, 6: *Probability (in white out-of-wedlock mothers, with level of income and marital status controlled) of going on welfare after the child is born*



Indeed, matching for social class of origin leads to an underestimate of IQ's full potency because such matching sets aside the influence of any genetic differences between the classes - Bouchard, 1995). Once upon a time, IQ may have correlated so well with parental affluence as to yield a correlation of +.63 between British soldiers' IQ's and the number of teeth in their heads (Eysenck, 1973, p.78); but today such correlations and the causation from SES that they betokened have been washed away by half a century of welfare capitalism. In today's conditions, at least, a Marxist tracing of adult outcomes to class origins is hopeless and IQ emerges as the major social variable - especially affecting outcomes across the bottom half of the IQ range.

Furthermore, Herrnstein & Murray's national longitudinal study of individual differences has been followed by Philip Rushton's (1995) compilation of evidence about group differences in outcomes such as early-and-often childbirth, promiscuity, rates of heterosexually transmitted AIDS and failure to provide for children. Other personality variables are certainly involved here: for example, East Asians' crime rates are even lower than would be expected from their 5-10 IQ point advantage. Yet IQ is still near the centre of the story of worldwide black-white-Asian cultural and economic differences, just as it is probably the key to major differences between young adults in the West in social and sexual behaviour (see Brand, 1995/6b). Even the worrying problem of aggression in children has turned out to be more a question of intelligence than of anything else: in 256 Dutch boys studied over three years, IQ was quite the strongest correlate (-.45) of their aggressiveness as rated by other children - quite dwarfing variables like social class, parental behaviour and the boys' own viewing of televised violence (Wiegman et al., 1992).*(16)* Instead of running from the realities of IQ, utopians will have to face the music. Do they want a society that idly tolerates its own undermining by the problems so often associated with low IQ? Or will they begin to address the question of what can be done to ensure freedom, welfare, and the maximum productivity and happiness for people and their children at all levels of intelligence?

Fortunately for those who seek amelioration of the human condition, the above four arguments about *g* 's importance do not exhaust the questions that can be raised about the practical relevance of *g* differences today. Higher general intelligence on its own is plainly a key to high attainments in many fields; but some crucial outcomes depend on other personal and environmental features and on how any particular *g* level is combined with them. For example, it is well known that people commonly prefer as friends and colleagues not especially the high-IQ (who might inspire them) or the low-IQ (who might defer to them) but those who are similar to themselves in intelligence. It is as if people function best and most happily in social micro-environments where similarity of intelligence assists mutual understanding. These social niches will often be selected and created by people themselves. People might be said to have marked preferences for the intellectual difficulty level of their immediate micro-environments (with whatever associates and tasks may be involved): they are affected by the intelligence of the environment, and their preferences reflect their own IQs. Thus strangers who meet in the psychology laboratory are more likely to report each other to have 'a good sense of humour' when their IQ's are similar (Nias, 1981); children's search for like-minded companionship begins at an early age (Janos & Robinson, 1985);*(17)* and gifted children, if they have any choice, make friends who are several years older yet similar to them in intellectual and emotional development (Gross, 1992; Silverman, 1993). As Gross (1994) has observed, the tendency to choose intellectually similar spouses and friends "may not be 'politically correct', but it is human nature."

Might individual choice of preferred micro-environment bring any benefits in education? It may seem unnecessary to ask such a question when people whom we know put so much effort into finding and persisting with courses of study, jobs and hobbies that 'suit them' - as being at least not too hard and not too easy. Likewise, it may seem strange to ask whether children of different abilities need different types and levels of teaching. There are in particular six pointers to what could be a wide agreement on providing individuation in education, as follows.

1. (1) Ancient. The original proponent of individualization of education was probably Quintillian. He observed in 70A.D.: "It is generally and rightly considered a virtue in a teacher to observe accurately the differences in ability among his pupils, and to discover the direction in which the nature of each particular pupil inclines him. There is an incredible amount of variability in talent, and the forms of minds are no less varied than the forms of bodies." The need to distinguish between children was subsequently recognized by such respected masters of pedagogy as Comenius (1592-1670), Locke (1632-1704), and Rousseau (1712-1778).*(18)*

2. (2) Pre-modern. Itard (c.1755-1838) was the French physician of empiricist persuasion who tried to educate 'the wild boy of Aveyron' (Itard, 1801 & 1806) and became the accepted pioneer of modern education. He expressly condemned "the defective management of education, whose principal fault is that it is essentially the same for all children and never adapted to the innumerable variations in the intellectual make-up of the individual"; and he even held this "principal fault" to cause and perpetuate "intellectual dullness" (quoted by Spitz, 1986).*(19)*

3. (3) Modern. Psychological research in education repeatedly shows that "qualitatively different alternative treatments are needed to adapt instruction to intellectual differences" (Snow & Yalow, 1982). Plainly, "if the students within [a] group are highly heterogeneous in preparation for learning....both the highly prepared and the poorly prepared are disadvantaged" (Humphreys, 1994). Jensen (1969, p.117) had made this point in his original critique of Head Start: "If diversity of mental abilities....is a basic fact of human nature....and if the idea of universal education is to be successfully pursued, it seems a reasonable conclusion that schools and society must provide a range and diversity of educational methods, programs, goals and educational opportunities, just as wide as the range of human abilities." (Jensen, 1969, p.117) By contrast, the demonstrable neglect of the educational needs of many children in modern schools is startling: 45% of Montreal fifth-grade children know 60% of their school curriculum (in French and maths) before the year's work begins (see Gagné, 1986). In a study of 160 gifted English children (IQ's 123-212), 60% of them were found to be doing classwork at a level more than four years below their actual attainments (Painter, 1976).

4. (4) Psychometric. The top 10% of 71/2-year-olds are higher in *g* than are children in the bottom

10% of 151/2-year-olds (Raven, 1989 - reporting new data on 3,250 British schoolchildren). These bright 71/2-year-olds thus have more objective psychological similarity with the 151/2-year-olds than with their chronological age-peers.

5. (5) British. In some areas of study, even the generally egalitarian educational system of modern Britain admits the need for distinctions: Britain provides specialized state schools where places are free-of-charge for children having special gifts and enthusiasm for ballet and music.

6. (6) Socialist. In the past, selection for grammar school according to IQ proved especially helpful in giving chances to working class children (whose primary school records were poorer than those of middle class children) (Floud & Halsey, 1957). Today, socialist spokespersons on education usually say that they favour courses being adapted to all children's "widely different aptitudes and abilities"; and they may even say that this was one of the original reasons for the replacement of Britain's grammar schools with comprehensives (Straw, 1992).*(20)*

Nevertheless, if it is 'common sense' to treat children according to their own particular abilities, talents, inclinations and even personalities (Sybil Eysenck, 1993),*(21)* why are children of the same chronological age so seldom taught according to their different general capacities to take things in - i.e. according to their levels of *g?* If the slightest importance were attached to providing such differential instruction at all economically, would not the children be taught in 'streams', 'groups', 'bands', 'tracks' or 'sets' (or whatever may be the educators' latest titles for the arrangement of treating like with like)? (Doubtless versions of streaming still exist in places, even within British state comprehensive schools: even comprehensive educators may admit the need for there to be 'sets' according to ability in the most academically demanding subjects. However, a British Professor of Education has insisted that, in his experience, British comprehensive schools generally try to maintain "broad banding" as far as possible - i.e. that they largely resist pressures for streaming. *(22)*)

In fact, it is well understood why streaming is seldom practised today in the state schools of the English-speaking world. It is impolitic to say that some children are duller than others, especially while little can be done about dullness. It is simply easier for educators to strip out recognition of difference than to build in the adaptation to g-levels that children require. Yet the rationale of current educational practice is incoherent, as follows.

EDUCATIONAL AND MEDICAL PHILOSOPHIES COMPARED

Generally speaking, modern liberal democracies do not pursue any objectives that interfere with equality of treatment - unless unequal treatments themselves serve to reduce prior inequalities that were still more conspicuous. For example, most state health expenditure is unequally targeted on people who are near death. In this case, what is achieved if things go well is preservation of life, thus postponing the most glaring inequality of all. This is not as inspiring a prospect as restoring younger patients to many years of health, but it is still an understandable ambition. In particular, it is egalitarian not just in the short term but also in the long term: whatever our youthful intentions, any of us may eventually wish the state provide for us, without charge, expensive but life-preserving medical treatments in the few months or years before we finally die.

In education likewise, equality of treatment means that no child is conspicuously favoured with an especially 'good' education unless other children also benefit. (Some children are withdrawn from the state scheme but their parents' tax contributions to the state scheme continue to assist other children.) The only exceptional state outlays not officially available to all are on children with 'special needs' and 'learning difficulties' - i.e. on children who usually have IQ's of less than 85. Thus the egalitarian principle is broadly maintained: the system may have its inequalities but they certainly do not operate simply to help anybody get ahead of anyone else.

However, in another way there is a stark contrast with state provision of medicine. In all this equality and provision for educational needs, where is the ingredient of 'life-saving' that provides the justification of the majority of expenditure on welfare state medicine? Where is the positive merit or virtue of state-educational arrangements? Or are they only justified negatively, by the singular merit of not transgressing the egalitarian imperative? Drug companies and brain surgeons have to produce positive evidence that their products and procedures work and that they do so without unacceptable side effects. In particular, it

has to be shown that 'treatments' do better than 'placebos' - where no active or expensive intervention is involved. Thus psychoanalysis is not usually available from the British National Health Service (or from medical insurance schemes in the USA): although it may benefit some individual patients, it is not the treatment of choice for the symptoms of any common diagnostic category. Yet, even though 'experimental' and 'control' groups should be much easier to arrange in education, where life is not at stake, there is no such equivalent positive evidence required in the world of education. (state education is possibly assumed to be a common-sense continuation of what parents mean by education, and thus to require no research into its efficacy. This would explain the sense of shock experienced by parents when they see how little is achieved for their children by the modern state school.)

Alternatively, it might be that nothing but a positive respect for 'equal rights' provides the sine qua non of state education. Perhaps comprehensive education is essentially an ongoing celebration of the wished-for community of equals? As such, its function might be essentially religious - providing through childhood an experience of apparent equality to make up for the loss of that equality of everyone before the Almighty that religion traditionally asserted in the past. However, if it is chiefly rights that are being acknowledged, what respect is accorded to that right of a child to be treated as an individual - without which treatment counting as 'education' can begin? Since low-IQ children can obtain special education according to their own 'needs', should not ability differences be admitted generally as primary creators of different educational 'needs'? Certain central concepts and values require assertion against both liberal and authoritarian educationists. According to the Oxford educator and moral philosopher, John Wilson (1994), one such concept is "that pupils may differ, and differ non-negotiably, from each other in respect of their abilities, aptitudes and attainments, as well as in their psychological needs and attitudes, and that these differences must be taken into account in the structure and organisation of their learning." Another is "that justice entails treating like cases alike, but unlike cases differently." Other educationists (Fiedler et al., 1993) quote Thomas Jefferson's 'Nothing is so unequal as the equal treatment of unequal people'.

Unlike hospitals, modern schools and educational authorities pursue their largely egalitarian ways without proving that they work and without any attention to a feature like intelligence that is a key aspect of human individuality. All told, it is hard to find the positive rationale for current educational practices; and, in so far as they are justified negatively as inoffensive to liberalism, special provision for the low-IQ would seem logically to require corresponding special provision for children of other IQ levels.

The inadequacies of modern state-educational philosophy cannot on their own constitute a conclusive argument for streaming. Practical objections are often raised against a thoroughgoing shift towards responding to children's IQ differences, so these too need consideration. What are the excuses that lead to the denial of *g* 's importance for how individual children should be educated? Four main arguments are commonly heard, as follows - though each has serious problems.

1. (1) Modern teaching methods allow all children, of whatever levels of ability, social advantage or deprivation, to work at their own pace within the mixed-ability class. This assurance is hollow. What happens in reality is that higher-IQ children spend their time either teaching their duller classmates or completing entirely non-essential 'projects' single-handedly or with the help of their parents and of equipment found at home. In either case, these children are simply being denied their right to an effective education. For example, why should they not learn the two or three languages and area-histories that are taught from an early age to the brighter children of other countries? (Or, if they are not considered to need more than English, what are they taught instead of the languages on which children in non-English-speaking countries have to spend so much time?). According to Scotland's Quality in Education Centre at Strathclyde University, "a 'fairly large' group of Scottish youngsters say they are not being challenged by their classwork" and a similar number report that their work is too difficult (McBain, 1996). Mixed-ability teaching may work in Japan: but there, classroom discipline and achievement motivation are high, and slower pupils attend out-of-hours classes to help them keep up. Notoriously, observers note the relative disorderliness and purposelessness of British school classes as compared to Japan (discipline) and France and Germany (streaming) (White, 1987). Strangely, it is almost as if the British educational experts who arrange all this reckon that intelligence is indeed all that matters: apparently they see little need for intelligence to be expressed and channelled, with the help of education, into as many high-level attainments as possible.

2. (2) True mixed ability teaching would be much easier if only the Government spent more on education to reduce class sizes. Yet class sizes in Britain are now typically a third of what they were before 1939. Meanwhile Britain's position in most international educational league tables has sunk from third to twenty-third: in mathematics, at age 13, British children now lag German children by 1 year and Japanese children by two years; and a MORI poll of British adolescents found that a third of them could not calculate a weekly wage from an hourly rate, and a quarter could not identify which direction on a map was north (Green & Steedman, 1993, pp.9, 31). Anyhow, research repeatedly finds children's educational outcomes quite unrelated to class size - as the Educational Secretary for England and Wales must repeatedly to explain to teachers who understandably find mixed-ability teaching a strain (see Eysenck, 1973/1975, p.134; Walsh, 1995): even a class size of six will be difficult for a teacher if children span the normal range of IQ. Small classes do not in fact lead to teachers adopting the acclaimed 'interactive' teaching methods;*(23)* and class sizes in Japan average over 40 while those of around 55 in communist China apparently work well (Walsh, 1995). For England and Wales, Her Majesty's Inspectors of Schools reported their conclusion by 1977 that mixed-ability teaching (at least for mathematics) primarily required "exceptional" teachers. Parents often seem to favour the small class sizes maintained by private schools; but such schools are streams in their own right - usually having no pupils of below-average intelligence.

3. (3) It would be uneconomic to teach a class of, say, eight-year-olds in three different ability groups. This objection presumes the creation of new classes. But what if the brighter eight-year-olds were simply placed with the nine-year-olds and the slower eight-year-olds with the seven-year-olds, and so on? Indeed, if economy were required, assignment-on-the-cheap could accord simply to a child's current school attainment and not to tested IQ - though selection by IQ would be fairer to disadvantaged and minority children than procedures involving teacher nomination (Baldwin, 1985). 'Mastery learning' (as it is called in the USA) ensures that learning has taken place before a child moves up the age range towards senior classes. Mastery was the main determinant of a child's school class until school numbers expanded in the 1920's (Gross, 1994). The practice of 'grade repeating' is widespread Japan, France and Germany (where ten per cent of children will repeat a year at some stage through their schooling). The glaring 'diseconomy' that requires attention is rather in modern teaching methods in the USA and Britain. These keep children together who in their free time choose very different paths of development. Why are children's own preferences thus disregarded?

4. (4) Mixing chronological ages is insensitive to children who have to 'stay down' and deprives them of the valuable models that brighter peers provide; and the brighter and younger children who were moved up a year are put at risk of sexual abuse and bullying. Such anxiety is baseless for four reasons, as follows.

    1. (i) Models. Discipline problems are the hallmark of the modern school, not of the pre-1960s school where children stayed down a year if they could not keep up. Children's troublesomeness and unhappiness are especially associated with feeling a failure at school and are reduced for low- and average-ability children when bright and gifted children are withdrawn from the classroom: lower-ability children then have a chance to excel (Kennedy, 1989). Fiedler et al. (1993, p.7) record a primary school pupil's comment: "When Bill [a gifted pupil] was in class, it was like the sun was shining on a bright, clear day. But when he went out to work with the other gifted kids, it was like when the sun goes over the horizon. The rest of us were like the moon and stars: that's when we finally got a chance to shine." Nor are average children 'deprived of role models': for they seldom identify with high-ability children, and usually take more interest in other children of similar ability who have succeeded in what they are trying to do (Schunk, 1987).

    2. (ii) Well-being. Psychologically, from all that is known of *g* 's influence on friendship formation, children will be happier mixing predominantly with others of a similar intellectual level. Reviewing the literature, Southern et al. (1989) observe:
    "Both early admission [to school] and later acceleration have been extensively studied.... Considering that the body of literature spans five decades and has consistently associated the acceleration of precocious young children with positive changes in their academic

achievement and a lack of negative effects on social or emotional growth, one might conclude that the questions regarding the advisability of acceleration have been conclusively resolved.... [Studies finding the contrary are] at worst fraught with severe methodological deficiencies and, at best, misapplied [e.g. examining young-in-grade children selected on the basis of chronological age alone, or because their parents were low-SES parents (of the 1950's) who wanted early school admission for the children chiefly because they were both working]."

The worry that grade-advanced children will not be of sufficient 'maturity', 'emotional age', 'emotional quotient' or 'moral development' to be able to cope is groundless: whatever educators mean by these terms is actually predicted better by tested Mental Age than by Chronological Age (see Boehm, 1962; Kohlberg, 1964; Hallahan & Kaufman, 1982; Tannenbaum, 1983; Janos & Robinson, 1985). The 'balance', 'social skills' and 'sense of responsibility' that teachers like to see are closely (though doubtless not exclusively) linked to *g* level: for example, on eleven of twelve measures of social and emotional adjustment, gifted children in Grade 3 were found to be more advanced than average children in Grade 6 (Lehman & Erdwins, 1981). There is simply no sound research basis for supposing that grade advancement will yield either social or emotional maladjustment (see Silverman, 1989, and Feldhusen, 1991). Research in France shows no harmful effect of redoublement on pupils' self-esteem, and even better subsequent progress for a proportion of grade repeaters (Robinson et al., 1992). Anyhow, since intellectual and emotional maturity are substantially correlated, conventional grouping by chronological age is no more justified by the emotional than by intellectual similarity of children so grouped.

3. (iii) Generation-mixing. The chronological-age divisions of schools should in any case be broken up. That each school 'year' lives in virtual ignorance of the others makes it hard for traditions and information to be passed down from one year to another. This too prevents children forming intelligent opinions that might lead to intelligent choice. - Divide and rule is, sadly, the slogan of the egalitarian educator.

4. (iv) Why compulsion? Why need there be compulsion at all? The most extraordinary feature of modern 'education' is children's lack of choice. So long as parents can provide a little daily guidance, most bright children are well served by the modern home with its illustrated encyclopaedia, radio, TV, video and personal computer. There is no reason at all to continue with the legalized compulsion of most current primary and secondary education.

Instead of the present coercion, schools should let all children try out classes in other years, if they and their parents desire; and provide all children with a continuing choice of difficulty levels in the subjects which they are taught. Allowing self-streaming by parents and children would doubtless threaten the authority of teachers. However, teachers today seldom claim to want to wield authority; so it would presumably suit them to function in an advisory capacity - free of the burden of mixed ability teaching and able to maintain their own specialist qualifications. The advisory system is what obtains in modern Germany. Here the traditional academic distinctions between schools and school classes are maintained on a voluntaristic basis. In most areas, parents have the legal right to send their children, however limited or lazy, to the 'grammar school' (Gymnasium) if they insist; but, when necessary, parents are cautioned that school standards will be fully maintained and that their child might have been happier and benefited more from the less academic, or more practically oriented curricula of a technical Realschule or vocationally oriented Hauptschule. (This tripartite division of secondary schooling was what Burt had planned for Britain in the mid-1940's; but few local educational authorities took the trouble to steer the brighter but less verbal children in the technical direction.)

Although children and their parents might welcome democratic self-streaming as best for their own children, would they actually be correct to do so? By 1982, researchers at the University of Michigan had conducted a 'meta-analysis' of the fifty-two high-quality studies of streaming to have appeared in the academic literature of modern education. They concluded that streamed pupils of all levels of ability did indeed show significant educational gains. The Michigan researchers also addressed anxieties about what happens to lower-streamed children. They wrote:

"[Some articles by other educationists] tended to emphasize the negative effects of grouping on the attitudes and self-concepts of low-ability students. Such conclusions, however, were based primarily on anecdotal and uncontrolled studies. The controlled studies that we examined gave a very different picture

of the effects of grouping on student attitudes. Students seemed to like their school subjects more when they studied them with peers of similar ability, and some students in grouped classes even developed more positive attitudes about themselves and about school."*(24)*

Subsequent researches by the Michigan team allowed an update confirming the original review; and other researchers also report favourably on streaming, grade advancement and differentiation of schoolchildren by ability (Nemko,1988; George, 1990; Quah, 1990; Jensen, 1991; Southern, 1993). Lately, in New South Wales, systematic efforts have been made to accelerate bright youngsters to into university - apparently with success (Croker, 1995).*(25)* Surveying forty years of studies for the American Research Center on the Gifted and Talented, Kulik (1991) concluded that "bright, average and slow youngsters profit from grouping programs that adjust the curriculum to the aptitude levels of the groups." Across five meta-analyses of gifted and talented learners, Rogers (1991) found that "full-time ability grouping (tracking) produced substantial academic gains." Coleman et al.(1993) reported that "the one common element" in successful education of gifted children was "that students were grouped by ability and/or performance for language, arts and mathematics instruction." Dooley (1993) found that "appropriate differentiated reading programmes are essential for the academic growth of gifted readers"; Maker (1993) includes several chapters which similarly favour tailoring of instruction within regular classes; and Fowler (1993) and Stanley (1993) both find gifted adolescents to make rapid progress when offered summer programmes of accelerated coaching. Even US law courts have come round to upholding practices of grouping because of evidence of beneficial outcomes to lower-track students (see Reschly et al., 1988). The value at all ages of 'matching' schoolchildren to tasks that are not too hard and not too easy for them has been repeatedly confirmed (St-J Brooks, 1989).*(26)*

Feldhusen et al.(1986) reference studies going back to 1959 and observe that few teachers can sufficiently individualize instruction within normal classes. Van Tassel-Baska (1992) likewise reviews the academic literature about acceleration (on which "perhaps more has been written....than about any other single educational intervention with any population"). She concludes that, while educational authorities shun the results of research, grouping by ability (accompanied by appropriately tailored curricula) enhances gifted children's achievements and "produces a positive attitude toward subject matter for all groups of learners". It has also become clear that the efficacy of educational procedures generally is more dependent on g-level than on any other variable. According to John Carroll (1993, pp.675-6), the effect of any given education will depend on the children's *g* levels - excepting only when the sheer power of *g* itself determines outcomes on its own, quite regardless of education. (The eminent psychologists, Lee Cronbach and John Snow once examined whether performance depended on particular mixtures of both aptitude levels and the teaching supplied. Carroll records their conclusion: "the pervasive correlations of general ability with learning rate or outcomes in education limits the power of Aptitude-Treatment Interaction findings to reduce individual differences.")

Such research developments and increased awareness of children's differences in educational research have occurred against a most unpropitious background. There have been little streaming and IQ-testing to study, and little encouragement for researchers. Streaming itself is the cardinal heresy of the modern English-speaking educator, as Jensen had found. Nevertheless, available results would seem to explain the long-term success of streaming arrangements in Germany and Russia, the continuing acceptability and success of binary education in Northern Ireland, the success of the few surviving English grammar schools (even after allowing for children's IQ's and socio-economic backgrounds), the maintenance of special lycées in Turkey and Azerbaijan for gifted children from disadvantaged backgrounds, the permission of 'grade skipping' in the state schools of France, Switzerland and New South Wales, and the recent shift in Denmark away from pursuit of educational 'equality' and towards children's 'optimal development' (e.g. Swing, 1994).*(27)* Even the 70% black Paideia schools of Chattanooga that pride themselves on democracy and egalitarian 'single-tracking' nevertheless maintain "leveled" sections for children's education in algebra (Wheelock, 1994). In contrast, the twenty-five year experiment with comprehensive schools in Britain has not even helped those who are so often put forward as the prime concern of the modern educator: children of working class origins now provide a lower percentage of university students than they did in 1970. Without the special provision for the bright that streaming makes, secondary school performance becomes mainly a matter of persistence with babyish exercises that are only tolerable to middle class students who have extremely middle class aspirations.

Behaviourism's inventor, John Watson, wasted very little of his own time on his bizarre idea that any child

could be trained to do anything and that children's training would not require careful attention to their own individual natures and mental abilities. Indeed, on leaving academic psychology he went on to succeed in the very different world of advertising: this area of endeavour typically requires shrewd assessment of what might serve as inducements for a small number of already product-prone consumers - that is, it requires close attention to enduring human differences. Even Watson's best-known behaviourist descendant, B.F.Skinner (1904-1990) declared, after years of behaviourist indifference to naturally occurring individuality :

"The phalanx was a great military invention, but it has long been out of date, and it should be out of date in American schools.... We would double the efficiency of education with one change alone - by letting each student move at his or her own pace." (Skinner, 1984).

- That each individual will have 'his or her own pace' (and other general, enduring and unlearned distinctions of personality) had long been acknowledged by Eysenck, but not by most behaviourists.

Today it is clear what should be done about the ideological extravaganza of the last generation of educators and their psychological advisers. Those appointed educational experts who have declined to attend to the phenomenon of intelligence differences will need to be granted early retirement; and children and parents will need an immediate offer of choice. To continue to be state-funded, schools should be required to demonstrate that, for the majority of the hours of the school day, most pupils have a choice as to which lessons to attend; and that the choice that is offered to them (and their parents) is between lessons of different levels of difficulty. A belief in freedom of choice is a value shared with pride by virtually all social and political groupings in the West: so, a century after the introduction of compulsion to attend school, it is time to deliver freedom and choice for schoolchildren. As one British political commentator puts it:

"It will soon be an article of faith among educationalists that mixed-ability classes are bad because they cheat clever children, middling children and dull children. There is nothing wrong with streaming so long as it is easy for children to move from one stream to another." (Massie, 1991)

A proper understanding of human intelligence does not lead to segregated schooling decreed by experts - whether by teachers or by psychologists. Anyhow, schooling is increasingly segregated already by what parents can pay for their house-locations so that their children can escape the low standard of much state education (Wooldridge, 1994). Rather, a proper understanding of *g* discloses the need to allow constant niche-selection by children themselves - at school as much as at home. To associate belief in genetic *g* with some kind of brutal pessimism and educational nihilism may seem progressive and radical; but it is actually a distraction from how egalitarian policies waste children's time in the name of communal harmony yet still require repeated and expensive state intervention in family life. Today's understanding of *g* requires full acknowledgement of the deep roots of human individuality; and of human non-malleability and obstinate unimprovability unless individuality is respected. Knowledge of *g* requires a drive towards individualization with regard to both family planning and education. Obliging parents to insure for the likely costs of educating their children to desired levels would ensure that thoughtful responsibility was taken for individual members of the next generation; and allowing education to be adapted to individual children via their choices would revolutionize our antiquated schools, keep parental costs down and make the taking of responsibility worthwhile.

Burt and the other IQ-testers first brought the opportunity of a good education to children from ordinary homes whose genuine capacities for learning had been neglected by the educational systems of their own day. Today, the abiding yet neglected phenomenon of IQ-differences points to expansion of choice in education. The scientific understanding of general intelligence shows the way out of the follies of an educational egalitarianism that tries to ignore *g* . Instead of defying the realities of intelligence, psychologists and educators must make use of them. These realities should be recognized both as licensing freedom of choice and as able to guide the provision of appropriately individualized opportunities for children. A century of successful intelligence testing and of failed schemes of egalitarian uniformity in the schools might thus end with appropriate educational provision for all children - the original goal of Binet as much as of Burt.

CONCLUSIONS

1. (1) The idea that general intelligence is important is easier to accept while there is a prospect of substantial IQ-boosting. Till recently, such hopes were seriously entertained - especially of pre-school Head Start programmes and of vitamin and mineral supplements. However, as Neisser et al. (1995) report for the American Psychological Association: "By the end of elementary school, there are usually no significant IQ or achievement-test differences between children who have been in [Head Start] programs and controls who have not." For the present, only increases in the proportions of infants that are breast-fed or adopted into high-IQ families offer much prospect of IQ-boosting.

2. (2) Lately, direct criticisms of the relevance of the *g* factor have proved popular. In particular, James Flynn has claimed that the twentieth-century worldwide IQ rise has had few noticeably good effects; and that the economic achievements of the East Asian peoples (in their own countries and in North America) cannot be attributed to their IQ's. Arguably, however, the worldwide expansion of university education is a direct and agreeable result of higher *g* levels; and group-administered IQ tests require a willingness to sacrifice accuracy for speed which probably makes them unfair to Asians. In the USA, Herrnstein & Murrary's (1994) The Bell Curve provides an extensive survey of thirty-year-olds who had been followed from mid-adolescence. It shows IQ to be quite the main predictor of lifestyle variables such as employment and law-abidingness; in particular, IQ today is much more predictive than an adolescent's social class of origin.

3. (3) Contrary to the rejection of 'streaming' by many Western educational experts, reflection and research continue to suggest the wide benefits of adapting the difficulty level of school classes to children's *g* levels. Streamed schoolchildren of all ability levels have been found to be happier and to reach higher levels of attainment. In interaction with appropriate educational provision, *g* is thus a most consequential variable in education: *g* and tailored education are the two pillars of the main aptitude x treatment interaction effect to be found in studies of school learning. Far from belief in IQ being what Walter Lippman once called 'a dogma' in which the task of education had given way to the doctrine of predestination, serious education begins precisely when g-levels are recognized.

4. (4) Achieving gains for children by g-adjusted education does not require expert adjudicators or IQ tests to stream children, nor even any insistence on assigning children according to expert advice. Very likely, in view of the sorts of choices they make about their friends, hobbies and TV programmes, children themselves would make sensible choices of school classes if they were only allowed to do so: they would choose classes pitched at their own g-levels - perhaps by joining children of a different chronological age. Instead of state schools providing a cross between a child-minding service and a reformatory, children should be allowed, at any time of day, a choice of classes of varying difficulty levels. After sampling classes arranged primarily for children of different chronological ages, children would usually settle to cleasses of the right degree of difficulty for them - though IQ test results would be provided if parents wished. Such liberation would unleash the power of *g* to produce improved attainments when coupled with appropriate teaching: it would counter the 'dumbing down' of education for which the past generation of educational experts and politicians has been responsible. As Gerard (1995) has remarked: "The literature is full of case studies of clever children who have been let down by the [educational] system. Under-occupied, bored and often bullied, many become alienated and disruptive.... ....Why is it such an outlandish idea for children to sit in different classes for different lessons? Is it such a threat to the order of our system to allow a primary school child to attend lessons at a secondary school, if he or she is able? No, we will have to do better. In the bold, difficult world of the new century, there can be no such concept as "too forward"." After years of stagnation, perhaps young people themselves will "smash the old oligopolies of learning" (Jenkins, 1995).

ENDNOTES:

1. Way ahead of his time, Burt became convinced of the intellectual equality of men and women by 1912 - on the basis of how the two sexes performed on the Binet tests. The idea that there were no differences in general intelligence levels between the sexes was to prove central to the most radical educational changes of the twentieth century. The higher level of *g* in Jews was known to psychologists in Hitler's Germany and has long been widely accepted (Lynn, 1992b). Galton's disparaging view of Jews and women was complemented by his marked admiration for the Scots: though one of his many surveys once recorded the women of Aberdeen as being the least physically attractive in Britain, Galton took Scottish genius very seriously - comparing 18th century Scotland to ancient Greece (as Winston Churchill would do subsequently).

2. Yerkes' (1921) US Army studies had found 89% of black recruits to be below MA 12. However, whites only scored around MA 13, educational provision for black children in those days was segregated, and black illiteracy rates meant that, in the absence of

express validation of the tests for illiterate testees, estimated levels of intelligence were only an informed guess. - See Chapter 1 for problems of interpreting the US Army study.

3. Shockley particularly observed that the crime rate in Denmark was only 2% of that in Washington and attributed this to the long-standing Danish discouragement of reproduction by feeble-minded persons. When the magazine Atlanta Constitution claimed that Shockley's ideas derived from Hitler, Shockley sued them for libel and won.

4. The effects of specific coaching on test performance can sometimes be considerable. After reading a relevant book and attending a training session, Dutch students showed gains equivalent to 15 IQ points on a well-validated test of numerical aptitude after being told how to search number sequences for regularities allowing prediction of the number that should 'come next'. However, an intelligence test using verbal analogies showed a coaching gain of only about 2 IQ points (Van der Molen et al., 1995). Probably, much depends on whether, prior to coaching, testees are familiar with items of the type used. Young children, to whom tests are more of a novelty, might thus be expected to show substantial gains from 'teaching the test'.

5. If admission to the prestigious University of California at Berkely accorded to educational grades rather than to race, the percentage undergraduates of Asian extraction would rise from 39% to >50% (Hodges, 1995).

6. As well as showing withdrawal, ritualistic behaviour and literalism, autists find it especially hard to recognize that people have their own beliefs and intentions. For example, if 'Sally' place a toy in a basket, but 'Anne' is seen to move the toy into a cupboard while 'Sally' is out of the room, autistic children expect 'Sally' to look in the cupboard for the toy on her return.

7. The degree of human superiority in intelligence defies quantification because of species' numerous differences in particular faculties (see Preface). But, though human symbol use in combination with reasonable *g* can be presumed to confer considerable powers of learning, there are equally clearly many forms of learning at which human beings have no conspicuous advantage or are possibly inferior. Classical, operant and identificatory types of learning would be examples - but there may well be others in association with special abilities such as long-distance navigation.

8. Further to this publication, the Irish Journal of Psychology carried discussions by Brand and Flynn that ended in accusations of logical errors and exhortations to undertake further work.

9. Peritz (1994) reports on 409 Californian adolsecents given vitamin-mineral supplementation for three months. Compared to 101 placebo controls, there was a gain of 1.6 points of Wechsler Performance IQ and a loss of 0.1 point on Verbal IQ. This difference between the Wechsler scales cannot be interpreted simply as a (modest) gain in gf unaccompanied by any change in gc - for three of the Wechsler verbal scales require active mental work as much as stored knowledge (see Chapter 1) Anyhow, Peritz freely allows that further research will be needed to show whether his effect "is large enough to be of practical importance."

10. A research team at the University of Glasgow reports that breastmilk-fed babies show superior development of the grey matter of the brain; and the researchers trace this finding reasonably enough to the fatty acids that are contained in breast milk but not as yet in man-made formulae for infant feeding. (BBC Radio IV UK News, 16 iii 1995) Fatty acids might boost IQ via their contribution to the development of the insulating myelin sheaths around nerves: myelinisation (the very process studied in animals by the young J.B.Watson for his doctorate - see Chapter I) speeds electrical transmission and is an important development across the first two years of life (Miller, 1994). Since individual differences in IQ only become reliably measurable after the second year of life, they might have their physical basis in how adequately the process of myelinization had proceeded in infancy.

11. University examining boards provide no public evidence of the correlations between component parts of their exams. This failure to provide elementary evidence of validity of their tests would be intelligible if such correlations are in fact often modest. That this is so is suggested by tbe notorious bunching of final marks in the middle of the range. This happens for many subjects having less than clear-cut academic standards - by contrast, law and mathematics yield a broader spread of marks (reported in Times Higher Educational Supplement, 26 v 1995, p.2). Bunching yields the familiar phenomenon of universities endlessly exhorting markers to use extreme marks - particularly in the hope of producing more First Class results. However, using a wider range of marks for individual exam papers will not help much when the different papers are poorly correlated; and low correlations may sink still lower when markers struggle to award high marks against their own better judgment. [The general decline of clear academic standards and the rise of 'anything-goes' relativism in the universities (especially in the humanities and social sciences) is well documented by Reading (1996).]

12. A person's IQ can be expressed in terms of standard deviations, upwards or downwards from the population mean: e.g. an IQ of 85 is '1 standard deviation low'. The relative SES of a person's parents can be expressed similarly. Thus people can be selected in research who are 'similarly low' in both IQ and SES.

13. Proving the hypothesis of 'increasing social stratification according to IQ' is hard because of limited historical data about IQ levels. However, few students at prestige universities today have any good friends who differ from themselves by more than fifteen IQ points: at least, they are unable to persuade any such friends to participate in psychological researches, as the many psychology theses testify which involve only student subjects. Apparently, little survives of the mixing of the social classes that used to occur in churches and soccer clubs - or in the University settlements of Burt's day.

14. Waller's finding was that father-son IQ differences correlated .29 with father-son SES differences. Difference scores are particularly

unreliable (since they are affected by the unreliability from both of the variables that contribute to them), so the 'true' correlation between Waller's variables would be around .50.

15. Like Rushton (1995), Flynn views the East Asians as more conscientious and controlled than Caucasians; though Flynn presumably believes these traits to be of environmental rather than genetic origin.

16. Wiegman et al.(1992) describe their work as follows. "....two cohorts of children [N =466], from old, city-centre districts and the suburbs participated... [Peer nomination assessment was used, based on the work of Eron (e.g. 1987). Positive significant correlations were found between TV-violence-viewing during the first two years and aggressive behaviour in the third year (boys .23, girls .29). Then] the influence of the starting level of aggression was statistically controlled for. The regression coefficients for both boys (.07) and girls (.10) were not significant.... The only variable which correlated significantly with both aggressive behaviour and TV-violence-viewing was intelligence. For the boys, significant negative correlations were found between intelligence on the one hand and aggressive behaviour (-.45) and TV-violence-viewing (-.28) on the other. For the girls, the correlations were not significant but pointed in the same direction.... Aggression of the parents was not correlated significantly with the child's aggressive behaviour or TV-violence-viewing.... For both the boys and girls, socio-economic status (SES) did not correlate significantly with aggressive behaviour.... it may be assumed that intelligence is one of the underlying factors which explain the relation between TV-violence-viewing and aggression."

17. The fact that children of normal intelligence do not seek out friends of lower intelligence makes the formation of relationships especially hard for the small minority of duller children who are present in 'integrated', mixed-ability classes.

18. Of course, mere antiquity of opinionation is of little merit of its own accord. Individualization of educational handling was expressly rejected by Saint Augustine, Martin Luther, Ignatius Loyola and John Knox (Snow & Yalow, 1982).

19. (I) Itard's empiricism was derived from reading John Locke and was well suited to pedagogic optimism. However, he was unable to train Victor, 'the wild boy', to use symbols - perhaps because (strangely) he did not try sign language; and the process of civilising Victor came to an end as Victor's sexual urges assumed paramount importance. (ii)Itard believed that intelligence was the result rather than the cause of experience; yet even he insisted on the importance of individuation of treatment - in response to whatever level of development was already detectable in a child.

20. Jack Straw (1992), a British Labour Party spokesperson on education, has claimed that the very name of Britain's "comprehensive" schools "conveys the clear understanding of those who developed the notion that it is precisely because children have individual talents and needs, and widely different aptitudes and abilities, that they should be offered a comprehensive range of courses and teaching and should not arbitrarily be sorted into separate categories of schools at 11...."

21. Eysenck (1993) notes that some researches show clearly "the success of educational methods differing according to the children's scores on Extraversion, Neuroticism and Psychoticism."

22. BBC IV UK on 30th March, 1993 (on a phone-in programme compèred by Nick Ross).

23. Researches find small classes do no better for children, or even that they are worse; but teachers and their unions pay no attention (Eysenck, 1975, p.134; Daily Telegraph, 14 viii 1978; BBC IV UK, 4 ix 1994). A small class will usually have the same ability range as a bigger one, so teachers can still not adopt differentiated methods that take pupils' abilities into account (Sunday Times, 20 ii 1983). In 1995, the Chief Inspector for Schools in England and Wales was reported as concluding from research that class size bears no simple relation to educational outcomes-though small classes may possibly help in the first two years of primary school (BBC IV UK, 10 xi, 0800hrs).

24. This extract is taken from the original research paper in The American Educational Research Journal, 1982.

25. Croker (1995) outlines Early Enrolment Scheme arrangements and gives detail of Patrick Morris-Suzuki, who was born in Bradford-on-Avon, England in 1976. He was accepted for the University of New South Wales in 1991, achieved first class honours with a mark of 95%, and registered there in 1994 for a Ph.D. on operator algebras (a branch of mathematics related to physics). Interviewed, Patrick, who also plays the flute for the UNSW orchestra, said: "I have no regrets with what I've done. When I first came here, there were some who thought I'd be better off socially with my own age level. In my case, that wasn't correct. I got along very well with fellow students. A friend of two years' acquaintance and another I'd known for 18 months who didn't know my age were both surprised when they found out."

26. St-John Brooks (1989) gives this summary of work by Professor N. Bennett (see also N.Bennett & J.Kell, A Good Start).

27. Even in Russia under communism, selective schools took in the top 2% of age cohorts at age14 (Sunday Times, iii 1980). That English grammar school pupils outperformed pupils of the same IQ's and social backgrounds at comprehensive and secondary modern schools was reported in The Times, 20 v 1983. (Indeed, it has been claimed that grammar schools are just about the only form of education to improve on the levels of attainment that would be expected from children's IQ's under under any educational provision at all (Vernon, 1979, Chapter 10).) In 1994, the New South Wales Board of Studies published thirty pages of 'Guidelines for the Selection of Students for Accelerated Progression' (i.e. guidelines for which pupils to accelerate). The Board accepted evidence that 60% of gifted children otherwise underachieve in school by at least 3 or 4 years, and that perhaps a fifth of them drop

out of high school in frustration. Typical candidates for acceleration would be expected to have "a large, advanced vocabulary for their age, the ability to discuss complex ideas and concepts, quick mastery and recall of factual information, creativity and imagination, enjoyment of reading, the ability to work independently...." - and many other attributes that are largely predictable from measured levels of *g* .

Epilogue - *'Lost! - Our intelligence? Why?'*

- *The realist position about g ; critics confounded.*
- *Why g nevertheless gets lost by psychologists.*
- *Advantages of re-discovery of the g factor.*

Despite hopes of banishing philosophy from its chosen terrain, twentieth-century psychology has remained a quasi-philosophical battleground. Striving to exorcize the abstract and the unobservable from psychology, behaviourists and their modern descendants in cognitive science border on 'epiphenomenalism' about the mind/body problem: they may allow that distinct, non-material mentality results mysteriously (or, as is said, 'emerges') from matter (i.e. from the brain); but they are unhappy discussing the measurable realities or the causal influences of

mental processes and proclivities themselves. In contrast, uninhibited by the self-denying ordinances of empiricism and behaviourism (which hold all abstract processes to derive from external referents), today's constructivists in developmental and social psychology assume that the only reality that we can know is social, ideational or linguistic. For them, genes, brains, mentality and mental powers are just bundles of terms thrown up in the course of human word games; and the language of 'mind' serves only the political purpose of establishing control of discourse and thus of life. On the one hand, the exponents of mind-body functionalism*(1)* say they would cheerfully attribute consciousness, intelligence and volition to a robot that could perform a few tricks of apparent 'representation' from some yet-to-be-written list. (The most humdrum feats of machine translation encourage them to believe that some kind of 'representation' simply must have occurred.*(2)*) On the other hand, their mirror-image bedfellows in modern idealism would attribute as much meaning and intelligence to the 'text' of a party political broadcast or diet advertisement as they would to the ideas ('rhetoric') and mental faculties of an actual human bein *g* ; and these constructivists would hope to appeal to Wittgenstein for a demonstration that there is, anyhow, no way out of the language games that enmesh us.

Rejecting these quasi-philosophical programmes, with their tendencies to reduce human mentality to bits of hard- or software or to snippets of discourse, the realists of differential psychology (and most especially of the London School) have insisted on three postulates.

1. The fully biosocial nature of a person.

2. The equally real existence of both mind and body.
3. The ability of psychology to achieve significant purchase on mental phenomena and mental differences by means that are at once genuinely objective and passably quantitative.

It is to be hoped that no one would expect a differential psychologist to solve 'the mind-body problem' - to explain how these two great realms of reality interact with each other as they do so especially yet so puzzlingly within the human person.*(3)* There is certainly no need to do so while cognitivists and constructivists simply decline to discuss mentality at all. Workaday scientists successfully describe and quantify, discover patterns, and provide modest explanations of other events and enduring realities. Perhaps London School psychologists can hope to do likewise in the realm of mentality while other mysteries wait their turn?

Even a modest realism about *g* enrages those who have made it their business to rail against the *g* factor. By the end of his spirited critique of IQ testing, Stephen Gould (1981) turned out to have big surprises for his readers. It transpired that he had after all no fundamental objection to 'reifying' those six-to-eight mental abilities that had once been proposed by Thurstone; indeed, he could even tolerate providing heritability estimates for them and talking about them 'pessimistically' as barely open to therapeutic modification. Yet, even after abandoning the philosophical stance that he had seemed to adopt in the first three quarters of his book, Gould felt obliged to draw the line at accepting a reified, heritable, none-too-changeable *g* factor. Perhaps more consistently, Steven Rose (1995) continues a

wider campaign against mental realism and continues to execrate reification of any kind: "Reification [whether of homosexuality, intelligence or aggression] converts a dynamic process into a static phenomenon.... If intelligence is one thing, it becomes appropriate to seek a single causative agent... We must abandon the unidirectional view of the causes of human action." It is certainly a mark of the seriousness of purpose of a critic of *g* that he would even suspend the forward direction of causality and replace it with a pantomime horse.

There is just one serious point in the writings of Gould and Rose on psychological matters - once what constructivists would properly call their 'rhetoric' is set aside. Both Gould and Rose are shocked at the prospect of a deterministic account of *g* that makes what they consider too little allowance for how interactive, as-yet-unrecognized parameters of influence on IQ could be changed. Yet this is strangely self-denying. First, it makes psychology a hostage to the undiscovered future. - Whereas, if it had to be guessed, the next century of data on *g* will most likely yield results broadly similar to those of the past. Secondly, the proper concern of Gould and Rose for human potential is strangely selective. It misses precisely those actual potentials for academic and moral growth that attention to the reality of *g* might already help to develop. Far from spreading gloom and despondency, to establish the reality of *g* is to clear a base for sensible and effective human choice: g's reality begins to define and clarify the real individuality of people; and it shows people and their would-be improvers where to start.

Some will say that the cause of 'realism' about

the human mind and the human person is but poorly served by the psychology of IQ. The IQ movement of psychometric psychology originated in Victorian elitism, it may be said. It avoided entanglement with Nazi-style statism and racism principally because Hitler banned the use of tests on which Jews did well. The London School's mid-century failure to identify elementary bases and correlates of intelligence robbed it of the appurtenances of science, so it had to lean especially on genetics. And then there was the sorry farce as its leading mid-century luminary scoured his attic and his coal-hole in the hope of finding for callers vital data on the most fully separated monozygotic twins to have featured in the scientific record. Yet such embarrassments meet their match in behaviourist and constructivist psychology. These other psychological approaches have readily rejoiced in the centrality of the state to human nature and in the state's social-engineering powers. The no-human-nature egalitarianism of many of their practitioners has thus been deeply embarrassed by the collapse of Marxist utopias in Eastern Europe - providing a decisive result in "one of history's largest social experiments"(Bouchard, 1995). It is the one-time heroes of historical materialism and nature-denying existentialism, not those of differential psychology, who, as national leaders, have killed millions of their own people (Mao, Pol Pot) and, as psychologists, attracted criminal convictions and prison sentences for fraud (the Milwaukee Head Start practitioners). The explanatory achievements of behaviourism and constructivism that are hard to recall despite these perspectives enjoying years of popularity among the intelligentsia (accompanied by multi-billion dollar expenditures on behaviourism and its cognitivist successor). Above all, psychologists who have spurned the *g* factor have been guilty of creating a Western equivalent of the

"ideological pseudo-reality" that Vaclav Havel and others exposed in communist Eastern Europe. By a 'collective fraud' (Gottfredson, 1994), they have condemned scientists and students, as Havel put it, to "live within a lie." Between them, psychology's inheritors of empiricism and idealism deny that much is known about the causes of unemployment, crime, welfare-dependency and the neglect and abuse of children: they betray people and psychology for the sake of another research grant.

In science, however, it is human achievements that count, not human weaknesses. So long as the measures and researches of science are not actually prohibited, science is naturally self-correcting. This has been the strength of the London School tradition. Spearman's successors have drawn upon, reinterpreted and integrated even the divergent achievements (and the still more divergent opinions) of Binet, Piaget, Schiff and Flynn (see Chapters I - IV respectively). The London School has articulated and developed methods of checking for 'bias' in tests, for the 'differentiation' of intelligence at higher *g* levels, and for the relation of *g* to personality. It has refined Spearman's early appreciation of the elementary bases of *g* and of how people cause their own environments (including others' attitudes to them) and thus express and develop their own real natures (as Aristotle first envisaged). It has continued and updated a way of describing and explaining human psychological realities that has provided the only robust, consistent and essentially unchanged psychology of the century. Throughout, it has seemed lastingly relevant to the liberation of children and adults from the similitarianism that is the sorry hallmark of much state intervention in human affairs. And

the new understanding of the basic nature of intelligence may even help to explain and justify the common idea that human intelligence exceeds that of animals: perhaps this popular understanding is just a rough extrapolation from the idea that intelligence is concerned with 'extracting information', even if what animals lack is not intake speed itself but the ability to enhance intake enormously by loading information into handy symbols? (A similar claim of twentieth-century development-with-continuity might be made for the ideas of Freud. However, most modern psychoanalysts are actually disloyal to Freud's stress on the centrality of sex and sex differences; and Freud's followers, unlike Galton's, never solved the problem of how to measure the key Freudian process of repression - thus preventing satisfactory quantification and evaluation of many other Freudian proposals.)

This book has set out the progress that has been made, despite failings from within and rage from without, in tackling the problems that were defined yet left as challenges by Galton and Spearman. Despite repeated sallies by experts in education, genetics, palaeontology, anthropology and nuclear physics, and despite the indifference of sociologists, social anthropologists and philosophers, conventional tests of general intelligence have not needed to have their moulds broken. Mental tests have proved reliable, predictive, fair to minorities and frankly a model of the sensitive, objective and professional yet data-seeking approach to people in times when so much else in psychology has little but buzz-words and platitudes to offer. To ceaseless criticism that 'nobody knows what intelligence really is', the tests have provided a direct answer in the *g* factor that - as seen in its correlations - varies so little from one set of superficially diverse

tests to another. More than that, the tests have realized the dreams of Galton and Spearman that, not too far beneath the complexities of everyday experience and valued abilities, some simpler strands of psychology might be discovered. Again, overcoming a century of feigned indifference to 'nature-nurture debates', psychogeneticists in the USA have been able to deploy the only long-term explanatory methods that human psychology has ever had, viz. those of twin and adoption study; and the result has been a decisive confirmation of a high heritability for *g* across a normal range of environments. Modern psychotelic investigation has confirmed the importance of IQ to adult lifestyles and self-made life chances. Most practically of all, there emerge reasons for allowing school pupils a choice of classroom difficulty levels; and, despite official indifference, there is mounting evidence that g-adjusted curricula are more effective and better enjoyed - even when children of different chronological ages are thus taught together.

In these pages, IQ - or, more precisely, the *g* factor - has thus proved to be a well-established variable in the realm of mentality. Many aspects of 'mind' are doubtless subtle and fleetin *g* ; and some are perhaps best left to the speculations and musings of philosophers and aesthetes. However, such scholars have not proved able to supply either evidence or arguments to rout the modern descendants of empiricism and idealism in psychology. Fortunately, on this psychological battlefield, little *g* is the Mighty Mouse - for all that sensitive souls may prefer to watch another match!

A wider question nevertheless remains for the overview of the psychology of intelligence that has been presented in this book. How can an aspirant science lose track of its main measurable variable? If the London School's account of *g* is indeed broadly correct and increasingly vindicated, why is IQ not standardly assessed in virtually all psychological research projects? How can a popular college subject like psychology have palmed off its students with the pursuit of a 'cognitive psychology' that has no theory of thought to its name and a social psychology that rejects measurement altogether? How can many modern psychologists have spent their time studying mainly subjects of above-average IQ, have pretended to themselves and their students that *g* differences did not exist, and yet have avoided professional malpractice suits for such neglect? How could Burt's establishment of educational psychology to guide remediation and tailored teaching have been spurned by psychologists just as by educationists? How could psychologists have come to favour studying the rat and the sophomore and, today, the computer, "virtual" reality and prospectively intelligent robots? Sadly, the following answers that can be offered to these questions are not very glorious; but at least the discoveries outlined in this book provide not just signposts but super-highways to a brighter future.

1. Personal reasons: bowing to wishful thinking. Towards the end of the behaviourist era in psychology, the American psychometrician-psychologist, Quinn McNemar (1961), queried why intelligence had been "lost" from the repertoire of academic psychology. It was not long before he received an answer - from the silence of the many

psychologists who did nothing to defend (or even to correct) Arthur Jensen's explanation of why Operation Headstart was failing. McNemar's question is worth repeating. Today, psychology has moved very far from the empiricism that had to prove everything tangibly and trace all psychological processes to observables: today, plenty of psychologists embrace the largely truth-free concerns of quasi-idealism, constructivism and 'discourse analysis'. What remains of science in psychology is chiefly a 'cognitive science' that seeks its metaphors of the human mind in robots which elude invention or demonstration but which are still put forward in grant proposals as able to provide a slave class for the future. Today, psychology's central doctrines are that everything is invented (social psychology) or that it soon will be invented (cognitive science). However, such guiding fictions are neither of them so far from the traditional aspirations of the behaviourist. In the early days of Watson and Skinner, former psychology and philosophy, and notions of consciousness and the unconscious, could be discarded; and it was expected that rigorous, abstraction-free laws of learning would soon enable the utopian transformation of mankind. Today the denial of human individuality in intelligence serves the same function. Russia under communism enforced Lysenko's 'genetics' whereby strains of wheat could supposedly adapt to being planted in winter, change their germ lines, and thus pass on their acquired learning to the next generation: Lysenko's revival of Lamarck's discredited ideas triumphed over the

genetics of Darwin and Mendel because it suited the utopian Communist ideology that nature could readily be changed for the better. Western psychologists' acceptance of their own society's febrile optimism is certainly one part of the story of how *g* is forced off the stage - today as much as was noticed by McNemar. Instead of rising to the challenge of real human nature, many psychologists have preferred piety.

2. Philosophical reasons: bowing to behaviourism. Despite its pretensions to independence, psychology is still beset by the problems of theology and philosophy from which many psychologists - beginning with John Watson - thought it would provide an escape. Through much of the twentieth century, psychologists felt obliged to accept the stern disciplines of philosophical empiricism and positivism: since they did not accept the Church or Scripture as authorities on human nature, psychologists wanted to show that they had equally demanding, objective and public criteria of their own as to what counted as truth. When empiricism and positivism were installed in psychology by the behaviourists, they provided less an Occam's razor than a chain-saw. IQ-type abilities had to be nothing but assemblies of relatively simple learned routines which, once their identification was complete, could surely be improved piecemeal in programmes of the Headstart type. IQ would thus fractionate on scientific analysis, just as the human mind, heart, soul and spirit were expected to be chopped into manageable pieces that

might even be force-fed successfully to a thorough-going materialist.

Today's psychology offers plenty of liberation from the behaviourists' proper concern with objective evidence. Early cognitivism first extended behaviourist disintegrative aspirations while relaxing the key restriction that all learning could be reduced to the specifiable types of conditioning (which restriction had provided the central discipline of behaviourism). Cognitivism took an equally disunitarian view of intelligence yet dropped behaviourist restraints. Soon cognitivism would be found retreating behind flimsy barricades of nativism: cognitivists usually admit an innate 'language acquisition device' though they have much less to say about it than Spearman had to say about g. Again, cognitivism notoriously tolerates minimally specified 'black boxes' for its ever-changing number of 'memory stores': the case for the reality of *g* is far stronger than that for the existence of any supposed 'type' of human memory. Other psychologists feel increasingly free to talk of self-images, identities, and the infant's theory of mind. Yet, far from psychologists growing in confidence about their new subject matter, there seems to be a feeling that the escape from empiricism will be short-lived. (No doubt this is partly because little measurement of anything is achieved by the liberated.) Strange as it may seem, behaviourism itself has reappeared in the popular idealist insistence that there is nothing beyond or behind people's behaviour, talk or (as is fashionably

said) 'texts'. As if fearing the behaviourist's scorn for abstraction and mentalism, the modern social psychologist simply avoids talk of ideas as well as mental realities - just like a behaviourist! In social psychology, the official end of behaviourism has yielded not realism but relativism - a refusal to accept that there are any truths at all about what people are really like. Piaget's modest rendering of intellectual development as a story of 'construction' was the previous high peak of idealism in psychology; but this is now far exceeded by social psychologists who reach back to Giovanni Battista Vico (1668-1744) for the view that truth and reality themselves are nothing but 'social constructions'. Thus the attempts of modern psychologists at empiricism and idealism have influenced discussions of intelligence; and served in particular to distract psychologists from the realism that is obviously the method-of-choice for handling a variable as measurable, as externally correlated and as well understood as g. Today, after prolonged flight from the measurable, it is time for psychologists to appreciate that the end of behaviourism allows quite as much room for the realism of Darwin, Galton and Burt as it does for the relativism of Vico, Nietzsche and Sartre.

3. Practical reasons: bowing to convenience. A third reason for psychology's tendency to lose touch with intelligence is practical. Psychology's perennial problem is that of finding subjects who can be tested relatively cheaply. Medicine solves this problem by using patients in hospital beds who will often co-operate with research while

they hope for treatment. Behaviourists solved the problem by studying rats; Piagetians solved it by studying infants; and cognitivists and the more advanced constructivists of social psychology solve it by hardly studying people at all - just building their computer 'models' or 'analysing' passages of 'discourse' selected for their ideological convenience. Clearly, differerential psychology should have followed Burt down the road to regular involvement in schools that he had opened up: most psychology departments should probably be located in or near a school - just as most medical faculties adjoin hospitals. But differential psychology and personality psychology rejected Burt's lead and chose for too long the superficially academic route of keeping up with the latest alleged advances in conditioning theory, 'social perception' or fissiparative neuropsychology. Thus differential psychology lost its natural subjects. This was disastrous for the study of *g* differences. It is only in normal schools that it is at all easy to study anything like the full range of human mental abilities. Many kinds of merely academic psychology can be done in the laboratory or in projects with handy collections of patients or employees (where selection, self-selection and resulting range-restrictions may be positive assets to the researcher of group effects). In contrast, the differential psychologist without a normal school with a full range of abilities will hardly ever see a correlation in excess of .40 between variables - let alone be able to examine it with colleagues and students who have a wider familiarity

with the same testees and the same tests. The simple result is that there is all too little good data to discuss. Nor do brief social surveys help. Only sheer accident remedies the domination of education and social survey work by bureaucrats who find it politic to view social class as their key variable: it was simply the US Army's desire to keep its test-norms up-to-date that enabled Herrnstein & Murray's (1994) unprecedented exploration of the psychotelics of intelligence which has probably buried social class for the foreseeable future.

4. Political reasons: bowing to the powers that be. A lack of good-quality data in differential psychology is precisely what some utopian idealists would wish. However, anti-realism usually involves more than happy fantasizing: there is usually a clear political agenda, of whatever 'left', 'right' or 'national redemption' origins. Support for anti-realism may stem from the left-wing belief in an equal world kept equal by state-funded experts in welfare redistributing the profits of such enterprise as is allowed; it may derive from a right-wing belief that most people can make a success of their local cultural tradition and the capitalist system if only they will work hard and behave themselves; or it may express a neo-fascist contempt for free-thinking artists, for intellectuals and for researchers who provide insufficient disparagement of enough minority groups and foreigners. Whatever the type of political encouragement, the resulting political meddling in education by ideologues results in neglect of

intelligence and of children's proper education. Most children need specialized as well as generalist education if they are to be employable; they need skill in the received forms of their own language; they need to know the major languages of the regions in which they will do business, take holidays and have voting rights; and they require education at difficulty levels that are suitable for each of them in view of their IQ's and previous attainments. The taking of IQ's allows proper assessment of which educational methods and which teachers produce 'value-added' effects (on top of the progress that can be expected from children's IQ's alone). For precisely this reason, the taking of IQ' s is spurned by politicians and teachers' trade unions. The high water mark of such unrealism is provided by the banning of IQ testing, the insistence on mixed-ability 'teaching' and by the programmes of 'affirmative action' (i.e. compulsory discrimination) in the USA. Astonishingly, most Western countries' records of their schoolchildren today contain more about the children's teeth than about their intelligence. Psychologists have not even taken a back seat in opposing the unjust and unproductive egalitarianism which swept to institutional power as a handy new rhetoric in the nineteen-sixties. Never before can psychologists have proved so shamelessly sycophantic to the powers of the day!*(4)*

Thus it is that psychologists are, at best, divided about their subject's most popular,

most predictive and most theoretically central variable. Social anthropologists believe human social phenomena are largely explicable in terms of systems of culture and kinship; classical Marxist sociologists think social class provides the explanation of a great part of the variance between people in how they live and who they think they are; geneticists are interested in what genes do; biologists study what living cells do; chemistry is about what atoms do; and physicists invoke sub-atomic particles. Yet what of psychologists? What are they interested in? How do they propose to explain their data on human behaviour and experience? To what key concepts will they repeatedly refer? After a century of coarse empiricism and relativistic idealism, it would be asking too much to expect that psychologists could be interested in 'the mind': that option would presumably be far too vague, far too reductionist, or both. Even such a familiar proposal as Freud's as to the mind's major components and levels of consciousness finds no general acceptance in psychology textbooks. It might have been thought that the concept of intelligence would provide at least a partial substitute - especially when general intelligence proves so easy to measure and so far-reaching as a predictor. Funnily enough, the idea that psychology is centrally concerned with 'cognition' has indeed appealed - even though virtually nothing of what cognitive scientists actually do answers interesting questions about what people think or why they think it. For the personal, philosophical, practical and political reasons indicated, intelligence is neglected. As Charles Murray (1992) has put it: "....there is an elephant sitting in the corner, which we have been trying to ignore for 30 years now."

If only a half of what has been said in this short

exposition is true, rediscovering intelligence will yield substantial practical and humanitarian gains. The result-oriented human endeavours that have been most successful this century are probably those of business, the military and medicine. In all these fields individual differences are taken extremely seriously. James Flynn may have been somewhat misled by Army data as to the extent and significance of inter-generational changes that he took to disprove the importance of g. But Project Alpha on the US Army provided the largest-ever trial of psychologists' capacity to help with effective and fair selection, and the most complete resultant vindication of IQ testin *g* ; and Herrnstein & Murray's US Department of Defense data have shown that, in today's conditions, IQ differences are much more predictive than anything to do with young adults' social classes of origin. In future, the need to adapt education and training to individual differences - first and foremost in *g* - will be increasingly embedded within educational efforts (especially once tailored, computerized instruction becomes at long last a normal educational option). Still greater gains can also be expected from the liberation of schoolchildren from chronological-ageism with which the arguments of Chapter 4 should assist.*(5)*

There is probably much room for an individualization of state provision that may release human forces as dynamic as does the interplay between supply and demand in free markets. Today, liberal capitalism has emerged triumphant from a century of horrors: but liberalism and capitalism are not themselves dynamic doctrines that say much about what the state should do. Rather, their strength is to spell out what not to do and thus to unleash the forces of human individuals and

their stored knowledge. It is time to realize that many features of individuality are quite unharnessed by state endeavours at present, even though state activity consumes around 40% of GNP in the West. As a test, individualizing state education according to intelligence and personal choice would show the way to a world in which the tyranny of states and their low-IQ local authorities was less feared. If the *g* factor were allowed its full play in schools, standards would rise rapidly and the real bases of achievement, creation, discovery and progress would be plain - in the human individual operating in conditions of freedom and dignity.

Success would blaze a trail to increased political freedom. In particular, the use of referenda (for long the most obvious way of extending democracy) might be accompanied by the further democratic advance of letting people themselves specify how their individual tax contributions be spent so long as they can demonstrate relevant knowledge. Letting people 'hypothecate' their taxes and vote on specific issues if they had relevant knowledge would similarly harness intelligence to politics.

Re-uniting psychology with education and with the cause of choice would realize Sir Cyril Burt's well-informed ambitions (however cavalierly pursued) and justify Arthur Jensen's persistence and his astonishing feats of martyred scholarship. It would also reassure Hans Eysenck and other loyalists of the London School. The realism that psychology must regain may have to override behaviourist dismissal of the existence of abstractions; but it can and must involve full commitment to inductive methods and data-gathering. For the desiderata of education and choice equally require constant study. Achieving them

depends upon objective assessment of the real differences that psychological science and psychological testing disclose. The concept of general intelligence itself emerged from data, and not from 'definitions' or the preconceptions of psychologists; and the outlawing of the use of IQ measures came as second nature to the twentieth century despots - tinpot and otherwise - who hoped people would forget the facts. Far from being an invention of educational elitists, the *g* factor is a reality discovered by science; yet egalitarian envy of excellence has meant that the discovery has yet to be harnessed to the advantage of all.

ENDNOTES:

1. Functionalism is the doctrine that a mental state is nothing but a functional state. Thus anything that so 'functions' as to translate sensory input into behavioural output is dignified with mentality. Under this doctrine computers would have mentality attributed to them if they could make stipulated input-output translations; and any further question of whether they actually 'saw', 'thought' or 'felt' anything is dismissed as irrelevant. Priest (1991) observes that functionalism "provides a philosophical framework within which to devise a scientific psychology without any need to address the ontology of a person." For example, pain is held to be not what is felt but what enables specific input-output transitions. The functionalist does not pause to ask whether pain could have the functional role it does unless it did actually hurt.

2. Instead of 'representing' the world or in any way thinking about it (or even making calculations or inferences about it) what computers do is to by-pass such processes while delivering what are for human purposes satisfactory input-output translations. A computer does not play chess; rather, it mimicks chess-playing. - If it did play chess, it would be appropriate to ask whether it enjoyed its game! (For a sustained refutation of the notion that computers or robots 'represent' or otherwise possess mentality, see Hacker (1990, Chapter I, 'Men, minds and machines').

3. The third realm of reality that was distinguished by Sir Karl

Popper is that of 'human knowledge'. This realm might be said to bear the same relation to that of active mentality as does *gc* to *gf*.

4. The kow-towing to latter-day liberalism was a far cry from the efforts of Galton and Burt - intent as they had been on sweeping away those privileges and practices that could not be justified by the psychological facts. Eventually voters in California and Colorado would seize their chances in referenda to begin to reverse the tide; but many nation-states do not trust their electorates to vote on issues. Here the treachery of state-salaried experts in psychology would long prove crucial to maintaining Spanish practices - i.e. education and employment practices that were mere job-creation schemes for bureaucratic practitioners of White guilt and noblesse oblige.

5. In terms of respect for the human indilvidual, it would still be proper to allow children a choice of difficulty levels in their school work even if IQ did not turn out empirically to be the main guiding influence in children's own decisions.

Dedication
Prefacing Quotations
About the Author
Foreword by the Author to the Precedent Edition
Press Coverage in 1996

TO DOROTHY, MY MOTHER

Prefacing Quotations

"....in regard to mental qualities, their transmission is manifest in our dogs, horses and other domestic animals. Besides special tastes and habits, general intelligence, courage, bad and good tempers, etc., are certainly transmitted."
Charles DARWIN, 1871.

"In course of time, there seems no reason why the intellective index (or system of indices) should not become so well understood, as to enable every child's education to be

properly graded according to his or her capacity. Thus the present difficulties of picking out the abler children for more advanced education and the 'mentally defective' children for less advanced would vanish in the solution of the more general problem of adapting education to all."
Bernard HART & Charles SPEARMAN, 1912.

"....the injunction to 'face the facts' has for too long been advanced within the delusion that 'the facts' are there and have merely been 'discovered' by psychometry.... IQ psychology subsists on a thin gruel of theory produced (in a way typical of the pre-paradigmatic sciences) under great ideological constraints in turn-of-the-century Britain.... The revived fashion for the g factor perhaps indicates a belated recognition among psychometricians of the shortcomings of operationalism, and the need to ground IQ psychology in a theory of intelligence."
Brian EVANS and Bernard WAITES, 1981.

"The big unreported story about the study of intelligence in the last decade is the remarkable resilience and importance of g."
Charles MURRAY, 1995.

ABOUT THE AUTHOR

The author is well known for his contributions to research and debate on intelligence and personality. He pioneered 'inspection time' testing in Britain and the USA. He lectures in psychology at the University of Edinburgh and is a Fellow of the Galton Institute.

FOREWORD BY THE AUTHOR TO THE PRECEDENT EDITION

- **On February 29th**, 1996, this book, THE *g* FACTOR, was published in the UK. by John Wiley & Sons Ltd. of Chichester. Several weeks later, on April 14th, London newspaper reports of interviews with me began to appear saying I thought Black people had a lower average IQ than did Whites; and that, since I thought psychology and race had deep links, probably substantially genetic, I had agreed I could be

called a 'scientific' - though not a common-or-garden - 'racist'.

- **On April 17th**, with the book was on the verge of publication in the USA, Wiley Inc., of New York, denounced (unspecified) views of mine, both relayed by the media and appearing in the book, as "repellent." Thus they were withdrawing the book from publication. UK Wiley promptly followed suit.

- **On May 31st**, Edinburgh University, having set up an Inquiry into me after students had demanded I be sacked, announced publicly that I was a fair examiner and that they would not be bringing any disciplinary charges against me for anything at all. However, they would be expecting {largely unspecified} improvements in my 'teaching style.' Apparently I would somehow need to cultivate better relations with students; and my Department would have to provide alternative coverage of the 'controversial' subjects on which I lecture. Privately, the University wrote to me to say I should go easy on sexual topics and provide the students with more spoonfeeding [handouts, visual aids]. I denounced the 'Inquiry' as a failed witch-hunt that had produced only a farce - while odiously reserving to itself the right to resume its unconstitutional inquisition at any moment of its own choosing.

- **On June 10th**, I began 'going public' (in emailed Newsletters and on the Internet) with my various offers to Wiley as to how to settle the dispute and re-publish the book. At the time of writing, however, Wiley have agreed to none of my offers.

The above is, I trust, an objective brief summary of what can readily be imagined to have been two months of grave uncertainty as to the fate of my friendships, my finances, my career and my book. Essentially I have been hounded for my realism about race and IQ by my publisher, many elements of the Press, left-wing academics such as Professors Steve Jones (University College London) and Steven Rose (The Open University), my students, the Anti-Nazi League and my own university. I have made many new and wonderful

friends in the course of all this. In particular, Calvin Langton, Ed Miller, John Pate, Bill Summers, Glayde Whitney, Rita Zürcher of the US National Association of Scholars (NAS) and John Furedy of the Canadian Society for Academic Freedom and Standards (SAFS) have provided invaluable support. However, the failure of politicians, lawyers, publishers and organized bodies to come to my support has been striking. In Britain, the only organized group to campaign conspicuously for my academic freedom of expression has been the Revolutionary Communist Party - though their efforts were ably complemented by those of the well-connected left-wing journalist Marek Kohn. Fortunately I have the 'old' form of academic tenure that is proof against my being made 'redundant'; but when a publisher can de-publish without consultation after a year of work and successful skipping through reviewers' hoops, it can be seen that the laws of contract and the arrangements for academic freedom of expression are both in a parlous state in the modern West. (Why did I not go to law? - For the usual reason. In Britain, only the very rich and the legally-aided poor can afford the gamble that breach-of-contract and defamation actions involve.)

Thus this edition comes about very much as an act of desperation - hoping to make my findings and views known despite truly vast efforts to frustrate me. In view of the many kind words that have been said about the book by eminent colleagues (notably Emeritus Professor Hans Eysenck, Institute of Psychiatry, University of London, Emeritus Professor Richard Lynn, University of Ulster, Dr Jim McKenzie, University of East London, and Professor Phil Rushton, University of Western Ontario), I have no doubt it is worth making this effort to reach out. I believe that only those who will scour the book for the alleged "repellent" passages will be thoroughly disappointed.

I have made minor corrections for this edition and am particularly grateful to John Loehlin and Glayde Whitney for improvements they drew to my attention. However I have done nothing to modify or remove any of the passages that might, on casual reading or quotation out-of-context, send the high priests of 'political correctness' into hysterics. Because I am here working from my disks of February 1995, not from Wiley's of February 1996, there will be many minor discrepancies between the two texts. However, anyone

wishing to check whether passages appearing here also appeared as such in the Wiley edition is welcome to check with me. (Please send in the article or chapter you have drafted, highlighting the quotations from 'THE '*g* ' FACTOR' that you wish to make and attribute to the Wiley edition, and I will check correspondence for you.)

There is much more to 'the Brand affair' than I dare risk boring some readers with in this Foreword to the book itself. So I will just indicate press coverage that interested readers may like to follow; and then give the Internet sites at which the day-by-day history of the affair is recounted. Professional coverage of the case is being maintained by Dr Martin Cloonan, Case Study Programme, Department of Politics, University of York, York Y01 5DD. In the USA, NAS offers an email service of my Newsletters and their own coverage of the affair: .

Press coverage

- *All Scottish newspapers* from April 15 for c. 10 days
- *Guardian* (London), 25 iv 1996 (E.Clouston, p.4)
- *New Scientist* (London) leading article 26 iv 1996
- *Times Higher* (London), 26 iv 1996, pp. 19, 48
- *Sunday Times* (London), 28 iv 1996, c.p5 also letter from Professor Hans Eysenck
- *US National Association of Scholars Science News List (NASSNL),* 29 iv 1996
- *BBC TV 2*, 'Newsnight', Tues 30 iv 1996, c.2305hrs
- *Guardian*, 1 v 1996 (Gary Younge, 'The gene genies')
- *Nature* (London) 2 v 1996, p.33

- *Science* (Washington), 3 v 1996, p.644, news report & photo
- *New Scientist* (London) leading article 3 v 1996
- *The Observer* (London), 5 v 1996, 'Arsenic and old race'
- *California Valley Times* 8 v 1996 (by Linda Seebach)
- *Nature*, 9 v 1996, news report & photo
- *National Association of Scholars*, Science News List (NASSNL), 9 v 1996
- *The Spectator*, 11 v 1996 (K.Malik,'Race towards censorship' pp. 19-21)
- *Chronicle of Higher Education* (Washington), 16 v 1996 (Liz McMillen)
  http://www.hrc.wmin.ac.uk/racegallery/
  (Website run by Marek Kohn, author of 'The Race Gallery')
- *Independent on Sunday* [Supplement], 19 v 1996 (M.Kohn) NASSNL, 22 v 1996
- http://www.nas.org/pressreleases/wiley.htm
  (Statement re Wiley DePublisher from US National Association of Scholars and the Canadian Society for Academic Freedom and Scholarship.)
- *BBC TV Scotland*, 31 v 1996
- *Evening News* (Edinburgh), 31 v 1996 : 'Uni warns race row author to steady on.But lecturer hits back at report.'
  BRAND:"It's entirely unsatisfactory that the University should produce this vague statement which I can't possibly reply to."
- *Chronicle of Higher Education*, 31 v 1996, p.A6
- *The Herald* (Glasgow), 1 vi 1996 (Lynne Robertson) : PICTURE CAPTION: 'Chris Brand: unrepentant after university inquiry.' "Mr Brand branded the university investigation as "no different from a witch hunt." He added: "It's obviously a relief when a witch hunt into anything and everything about one is called off for a while.""
- *The Scotsman* (Edinburgh), 1 vi 1996 (Graeme Wilson, p.5)
- *The Morning Star* (London), 1 vi 1996 (Our Scottish Correspondent) 'Lecturer told to 'modify' style.'
  "[According to Dean MacCormick] the psychology department is to "redistribute the teaching workload in relation to such controversial topics as intelligence as intelligence and personality"."

- *Guardian* (London), 1 vi 1996 (Gary Younge, p.6, Home News)
- *The Scotsman*, 5 vi 1996 ('Academic freedom undermined', letter from Hugh Peto & Fiona McEwan)
- *Times Higher*, 7 vi 1996 ('Call for improved Brand', p.2, by Aisling Irwin & Olga Wojtas)
- *The Guardian*, 7 vi 1996 (Prof. Steve Jones [University College London], p. 19)
- *Radio Leeds* (UK), 10 vi 1996, c.11.10hrsGMT (Producer Hilary Robinson)
- *NASSNL*, 12 vi 1996, Item 5.
- *Science* 272, 14 vi 1996, 'University review leaves iconoclast intact' (p. 1593).
- *American Renaissance*, vii 1996 (News and book review by Jared Taylor and Thomas Jackson)

My Newsletters about the affair, their back-copy Archives, and Summaries of the *THE g FACTOR*'s four chapters can be found on the Internet at the following sites. http://www.ed.ac.uk/~crb/book/ and http://www.webcom.com/zurcher/thegfactor/index.htm

CHRIS BRAND
EDINBURGH, JULY 1996

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STATISTIQUES SUR LE QI (FRANCAIS *ENGLISH*)

DERNIERS AJOUTS : 31-03-02

Dernière Mise à Jour : undefined NaN undefined NaN

A LIRE EN PREMIER

DISCLAIMER

Cette page (en construction) a pour objectif de rassembler le maximum de chiffres concernant le QI. Il ne s'agit QUE du report des résultats d'études scientifiques : aucune analyse n'est faite.
Pour avoir une explication des concepts statistiques (et des risques d'erreurs d'interprétation) voir la page Statistiques.

This page is no more than a collection of statistics facts upon IQ : no analysis is done.

AIDE

La colonne de gauche (REF) reporte aux sources qui sont détaillées en bas de page.
Les QI sont présentés selon la norme Wechsler (M=100, SD moyen=15 voir ci-dessous)

- *TBC = The Bell Curve* - Herrnstein & Murray - 1994 - Free Press - NY
- *Brand 1996 = The g Factor - General Intelligence and its Implications* - Christopher Brand
- *Jensen 1998 = The g Factor - The Science of Mental Ability* - Arthur R. Jensen

The fist column (REF) refer to the sources which are detailed at the bottom of the page.
IQ are calculated with the Wechsler norm (M=100, average SD = 15)

SOMMAIRE

(liens)

Ref	DES HOMMES ET DES FEMMES *(OF MEN AND WOMEN)*	HOMMES *(MEN)*	FEMMES *(WOMEN)*	ENSEMBLE *(TOGETHER)*
	QI Moyen *(Average IQ)*	100	100	100
14	Ecart-Type *(Standard Deviation)*	15,5	14,5	15
0	Pourcentage de personnes ayant un QI supérieur à 100 *(Percent of people with an IQ exceeding 100)*	50,00%	50,00%	50,00%
0	Pourcentage de personnes ayant un QI supérieur à 115 *(Percent of people with an IQ exceeding 115)*	16,66%	15,04%	15,87%
0	Pourcentage de personnes ayant un QI supérieur à 130 *(Percent of people with an IQ exceeding 130)*	2,65%	1,93%	2,28%
0	Pourcentage de personnes ayant un QI supérieur à 145 *(Percent of people with an IQ exceeding 145)*	0,18%	0,10%	0,14%
0	Pourcentage de personnes ayant un QI supérieur à 160 *(Percent of people with an IQ exceeding 160)*	0,006%	0,002%	0,003%

Ref	HERITABILITE DU QI *(IQ HERITABILITY)*	Corrélation *(Correlation)*
1	Jumeaux Monozygotes élevés ensemble *(Monozygotic Twins reared together)*	0.86
2	Jumeaux Monozygotes élevés ensemble *(Monozygotic Twins reared together)*	0,85
2	Jumeaux Monozygotes élevés séparément *(Monozygotic Twins reared apart)*	0,74
2	Jumeaux Dizygotes élevés ensemble *(Dizygotic Twins reared together)*	0,59
2	Frères et soeurs élevés ensemble *(Siblings reared together)*	0.46
1	Frères et soeurs ou Dizygotes élevés ensemble *(Siblings or Dizygotic Twins reared together)*	0.45
2	Enfant et Moyenne des parents, vivants ensemble *(Mid-parent / Child together)*	0,50
2	Enfant et parent célibataire vivant ensemble *(Single parent / Child together)*	0,41
1	Frères et sœurs ou Dizygotes élevés séparément *(Siblings or Dizygotic Twins reared apart)*	0.40
13	Entre Mari et Femme *(Between Husband and Wives)*	0,45
17	Entre Mari et Femme *(Between Husband and Wives)*	0,37

18	Entre Mari et Femme aux USA *(Between Husband and Wives in USA)*	0,33
1	Demi-frères et demi-soeurs élevés ensemble et vivant dans le même milieu *(Half siblings reared together)*	0.20 à 0.30
2	Enfant et parent célibataire vivant séparés *(Single parent / Child apart)*	0,24
2	Parent adoptif et enfant vivants ensemble *(Adopting parent / Child together)*	0,20
1	Cousins et cousines élevés ensemble et vivant dans le même milieu *(Cousins reared together)*	0.15
20	Personnes sans parenté génétique élevées ensemble : pendant l'enfance *(Personns without any genetic parenty reared together : during childhood)*	0,25
20	Personnes sans parenté génétique élevées ensemble : à maturité *(Personns without any genetic parenty reared together : when adults)*	- 0.01
19	Evolution de l'héritabilité avec l'âge *(broad heritability according to age)*: - Enfants *(Children)* - Adolescents et jeunes adultes *(in adolescents and young adults)* - A Maturité *(Later maturity)*	 0.40 à 0.50 0.60 à 0.70 Presque (*approaches*) 0.80

Ref	CORRELATIONS DIVERSES DU QI AVEC :	Corrélation
7	Taille de la tête *(Head size)*	0,40
8	Niveau d'agressivité en école primaire	-0,45
9	Conservatisme social	-0,45
15	Notes de performance professionnelle *(Validity predicting Job Performance Rating)*	0.53
16	Myopie *(Myopia)*	0.20 à 0.25

Ref	QI MOYEN	QI	% > 100*
4	Noirs Américains (en moyenne à 75-80% d'origine Africaine)	85	16
22	France : QI Moyen de l'enfant si le père est Manoeuvre	92	30
3	Population carcérale aux USA	92	30
22	France : QI Moyen de l'enfant si le père est Agriculteur	96	41
3	France : Equivalent du Baccalauréat (avant réforme visant à admettre 80% de la population au Bac...)	100	50
5	Population d'origine Européenne prise dans l'ensemble *(average European)* pour les tests Français	100	50

22	France : QI Moyen de l'enfant si le père est Employé de Commerce	100	50
4	Asiatiques (Extrême Orient et Indiens)	106	66
22	France : QI Moyen de l'enfant si le père est Cadre Moyen	107	30
22	France : QI Moyen de l'enfant si le père est Cadre Supérieur	112	78
4	Ashkenazes (Juifs Européens)	115	85
3	1 ° niveau de diplôme universitaire	115	85
3	Plus hauts diplômés Américains	145	99

** : Pourcentage de personnes de la population considérée ayant un QI supérieur à 100 (REF = 0)*

Ref	IMPACT SUR LE QI MOYEN (EXPRIME EN POINTS QI WECHSLER)	IMPACT	% > 100*
10	QI des schizophrènes hospitalisés par rapport à la population générale correspondante (exprimé en relatif)	-31	2
10	QI des schizophrènes non hospitalisés par rapport à la population générale correspondante (exprimé en relatif)	-13	19
21	QI des Jumeaux Monozygotes si les deux naissent viables (exprimé en relatif)	-5	37
21	QI des Jumeaux Monozygotes dont un est mort-né (exprimé en relatif)	0	50
24	QI des enfants de 9 ans ayant souffert au moins une fois par an du parasite G. lamblia (provoque des diarrhées)	-4	40
24	QI des enfants de 9 ans ayant souffert de malnutrition chronique pendant les deux premières années ayant entrâiné un retard de croissance	-10	25

** : Pourcentage de personnes de la population considérée ayant un QI supérieur à 100 (REF = 0)*

Ref	QI MOYEN SELON LE PLUS HAUT PROBLEME JUDICIAIRE VECU CHEZ LES HOMMES BLANCS (US) *(DEEPEST LEVEL OF CONTACT WITH THE CRIMINAL JUSTICE SYSTEM (WHITES MALES))*	QI	% > 100*
6	Aucun contact *(None)*	106	66

6	Arrêté par la police mais pas retenu *(Stopped by the police but not booked)*	103	58
6	Retenu mais pas inculpé *(Booked but not convicted)*	101	53
6	Inculpé mais pas incarcéré *(Convicted but not incarcerated)*	100	50
6	Condamné *(Sentenced to a correctional facility)*	93	32

** : Pourcentage de personnes de la population considérée ayant un QI supérieur à 100 (REF = 0)*

Ref	STATISTIQUES DIVERSES CONCERNANT LE QI	CHIFFRE
12	Sur les crimes commis par les enfants scolarisés aux USA pourcentage de ceux commis par les QI compris entre 70 et 100	74%
0	QI du Baccalauréat si 80% de la population doit l'obtenir	88
16	Pourcentage de femmes dépassant la moyenne des hommes en visualisation spatiale *(Percent of females exceeding the male median in spatial visualization ability)*	25%

Ref **QI MOYEN PAR PAYS SELON R. LYNN & T VANHANEN ET REUSSITE ECONOMIQUE** **CHIFFRE**

23 **CONSULTER LE LIVRE POUR AVOIR LES SOURCES DES DONNEES !**

La thèse du livre est qu'environ 60% de la variance économique entre les pays s'explique par le QI moyen de la population. Toujours selon Lynn &Vanhanen, 3 éléments viennent baisser la corrélation (qui, sans eux, serait plus importante) :

- Le degré de liberté économique : les pays ayant vécu (ou vivant encore) le communisme sont bien sûr beaucoup plus pauvres que les autres
- La quantité des ressources naturelles (ex : le pétrole au Moyen-Orient)
- L'organisation interne du pays : mettre l'élite intellectuelle au pouvoir économique augmente la richesse globale de tous.

LEGENDE :

- Average IQ = QI Moyen
- GDP = PIB (Produit Intérieur Brut)
- Fitted GDP (FGDP) = GDP recalculé selon le rapport moyen trouvé par Lynn et Vanhanen
- GDP / FGDP = indique si le pays réussit mieux ou moins bien que son QI ne le laisse supposer

Country	average IQ	GDP	fitted GDP	GDP/FGDP
Hong Kong	107	20 763	19 817	1,0477368
Korea, South	106	13 478	19 298	0,6984143
Japan	105	23 257	18 779	1,2384579
Taiwan	104	13 000	18 260	0,7119387
Singapore	103	24 210	17 740	1,3647125
Austria	102	23 166	17 221	1,345218
Germany	102	22 169	17 221	1,2873236
Italy	102	20 585	17 221	1,1953429
Netherlands	102	22 176	17 221	1,2877301
Sweden	101	20 659	16 702	1,2369177
Switzerland	101	25 512	16 702	1,5274817
Belgium	100	23 223	16 183	1,4350244
China	100	3 105	16 183	0,191868
NewZealand	100	17 288	16 183	1,0682815
U. Kingdom	100	20 336	16 183	1,2566273
Hungary	99	10 232	15 664	0,6532176
Poland	99	7 619	15 664	0,4864019
Australia	98	22 452	15 145	1,4824695
Denmark	98	24 218	15 145	1,5990756
France	98	21 175	15 145	1,3981512
Norway	98	26 342	15 145	1,7393199
United States	98	29 605	15 145	1,9547706
Canada	97	23 582	14 626	1,6123342
Czech Republic	97	12 362	14 626	0,8452072
Finland	97	20 847	14 626	1,4253384
Spain	97	16 212	14 626	1,108437

Argentina	96	12 013	14 107	0,8515631
Russia	96	6 460	14 107	0,4579287
Slovakia	96	9 699	14 107	0,687531
Uruguay	96	8 623	14 107	0,6112568
Portugal	95	14 701	13 589	1,0818309
Slovenia	95	14 293	13 588	1,051884
Israel	94	17 301	13 069	1,3238197
Romania	94	5 648	13 069	0,4321677
Bulgaria	93	4 809	12 550	0,3831873
Ireland	93	21 482	12 550	1,7117131
Greece	92	13 943	12 031	1,1589228
Malaysia	92	8 137	12 031	0,6763361
Thailand	91	5 456	11 512	0,4739402
Croatia	90	6 749	10 993	0,6139361
Peru	90	4 282	10 993	0,3895206
Turkey	90	6 422	10 993	0,5841899
Colombia	89	6 006	10 474	0,5734199
Indonesia	89	2 651	10 474	0,2531029
Suri name	89	5 161	10 474	0,4927439
Brazil	87	6 625	9 436	0,7020983
Iraq	87	3 197	9 436	0,3388088
Mexico	87	7 704	9 436	0,8164476
Samoa (Western)	87	3 832	9 436	0,4061043
Tonga	87	3 000	9 436	0,3179313
Lebanon	86	4 326	8 917	0,4851407
Philippines	86	3 555	8 917	0,3986767
Cuba	85	3 967	8 398	0,4723744
Morocco	85	3 305	8 398	0,3935461
Fiji	84	4 231	7 879	0,5369971

Iran	84	5 121	7 879	0,6499556
Marshall Islands	84	3 000	7 879	0,380759
Puerto Rico	84	8 000	7 879	1,0153573
Egypt	83	3 041	7 360	0,4131793
India	81	2 077	6 322	0,3285353
Ecuador	80	3 003	5 803	0,517491
Guatemala	79	3 505	5 284	0,6633232
Barbados	78	12 001	4 765	2,5185729
Nepal	78	1 157	4 765	0,2428122
Qatar	78	20 987	4 765	4,4044071
Zambia	77	719	4 246	0,1693358
Congo (Brazz)	73	995	2 170	0,4585253
Uganda	73	1 074	2 170	0,4949309
Jamaica	72	3 389	1 651	2,0526953
Kenya	72	980	1 651	0,5935796
South Africa	72	8 488	1 651	5,1411266
Sudan	72	1 394	1 651	0,8443368
Tanzania	72	480	1 651	0,2907329
Ghana	71	1 735	1 132	1,5326855
Nigeria	67	795	- 944	-0,842161
Guinea	66	1 782	- 1 463	-1,218045
Zimbabwe	66	2 669	- 1 463	-1,824334
Congo (Zaire)	65	822	- 1 982	-0,414733
Sierra Leone	64	458	- 2 501	-0,183127
Ethiopia	63	574	- 3 020	-190,0662
Equatorial Guinea	59	1 817	- 5 096	-0,356554

Ref SOURCES

0 Calcul pour une moyenne de 100
ATTENTION : n'est valide que si la représentation des QI dans la population considérée suit bien une courbe en cloche (cela est vrai pour la population générale mais pas forcément pour une population particulière)
SE RAPPELLER EGALEMENT que les variations à l'intérieur d'un groupe sont généralement plus importantes que les variations entre les groupes : il ne s'agit que de moyenne

1 Jaques Bénesteau (sur ce site)

2 Devlin, Daniels and Roeder - Nature 31-07-97 - Méta-analyse de 212 études (50 000 paires) - Voir page de Arthur HU

3 Herrnstein & Murray - The Bell Curve (1994)

4 Estimation Arthur HU *(Estimate Arthur HU)* - voir sa page

5 Par définition

6 TBC pp 246-247

7 Jean-Philippe Rushton - 2000

8 Wiegmann et al. 1992 (Cite par Brand 1996 pp 154 et 207) WIEGMAN, O., KUTTSCHREUTER, M. & BAARDA, B. (1992). '*A longitudinal study of the effects of television viewing on aggressive and prosocial behaviours*.' British Journal of Social Psychology 31, 147-164.

9 Egan 1989

10 John Crawford 1992

11 White, K.R. 1982 (cité in Brand 1996) *The relation between socioeconomic status and academic achievement* Psychological Bulletin 91, 3, 461-8

12 Yoshikawa

13 Jensen A.R. 1978 (cité in TBC pp 110 et 687) : *Genetic and behavioral effects of nonrandom mating*. In *Human Variation : Bpopsycholgy of Age, Race and Sex*. R.T. Osborne, C.E. Noble, and N. Weyl (eds.). New York : Academic Press, pp. 5-105
Voir aussi : Jensen 1998 p 183

14 Chris Brand

15 Hunter J. E. & Hunter R.F. 1984 (cité in TBC pp 81 et 575) : *Validity and utility of alternative predictors of job performance*. Psychological Bull. 96:72-98

16 Jensen 1998 - p 149

17 Phil Rushton in '*Race, Evolution and Behaviour*' (1995), p70 (Diagram)

18 Tom Bouchard and Matt McGue in *Familial studies of intelligence* (1981, Science 212, 4498, 1055-1059)

19 Jensen 1998 - pp 169 et 178 + graphique page 179 from Mac Gue 1993 : voir REF 20 ci-dessous

20 Jensen 1998 p 178 - Sources citées :
Mc Gue et al., 1993, pp. 60-67 (*Behavioral genetics of cognitive ability : a life time perspective* in R. Plomin & G.E. McClearn (Eds.), *Nature, Nurture, and psychology* (pp 59-76). Washington, DC: American Psychological Association)
Scarr, 1989 pp 103-105 (*Protecting general intelligence : constructs and consequences for interventions*. In R.L. Linn (Ed.), *Intelligence : Measurement, theory, and public policy* (pp 74-118) Chicago : University of Illinois Press)
Segal 1997 (*Same age unrelated siblilngs : a unique test of within-family environmental influences on IQ similarity* Journal of Educational Psychology, 89, 381-390)

21 RECORD, R. G., McKEOWN, T & EDWARDS, J. H. (1970). An investigation of the differences in measured intelligence between twin and single births. Annals of Human Genetics 34, 11-20.

22 INED (France) 1973

23 Lynn et Vanhanen 2002 : "*IQ and the Wealth of Nation*" - Praeger (USA) 2002

24 Douglas S. Berkman et al.: "*Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: a follow up study*" in The Lancet 16-02-2002

POUR EN SAVOIR PLUS

SUR CE SITE :

- FAQ QI
- FAQ Intelligence
- Tableau de conversion des QI
- Synthèse de Jacques Bénesteau sur l'Héritabilité
- Revue du livre de Chris BRAND "The *g* Factor" (Download the Book !)
- Présentation du WAIS (Wechsler pour Adultes)

AUTRES SITES :

- Voir la liste de liens sur la page Source