

PUTTING METHOD FIRST: RE-APPRAISING THE EXTREME DETERMINISM AND HARD HEREDITARIANISM OF SIR FRANCIS GALTON

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INTRODUCTION

In June and August 1865, the scientific polymath Francis Galton (1822–1911) published an article entitled “Hereditary talent and character” in the popular periodical *Macmillan’s magazine*.¹ In this article he sought to demonstrate that human intelligence is largely under the control of heredity and only modestly affected by environmental conditions. Having listed the interrelationships of several generations of judges, men of science and men of letters, Galton calculated that a high proportion — ranging from nine to thirty-three percent depending on the bibliographical dictionary used — were closely related to at least one other distinguished personage. He interpreted this as unequivocal evidence for the primacy of nature over nurture in determining intellectual ability, and promptly called for the imposition of controls on human breeding. Four years later, he devoted several additional months to collating the pedigrees of the eminent and presented the results in *Hereditary genius* (1869). Despite the lukewarm critical response to these works, over the course of the following four decades Galton published extensively on subjects relating to mental heredity, the physiology of hereditary transmission, and the statistical analysis of heredity. This corpus of work now occupies a very important position in modern accounts of the history of genetics and eugenics. In particular, congruent with his role as the putative “father of eugenics”, Galton is often identified as among the chief architects of the social hereditarian and degenerationist ideologies of the *fin-de-siècle* period.² He largely owes this status to having advanced an extremely deterministic model of mental heredity during and after the 1860s, in a manner (according to several historians) quite out of keeping with prevailing philosophical, medical and moral sentiments.³ Additionally, over the past three decades, historians have credited Galton with anticipating August Weismann’s rejection of theories of the inheritance of acquired characteristics (‘soft’ heredity) in favour of ‘hard’ hereditarianism.⁴

Both Galton’s extreme determinism and hard hereditarianism have been the subject of several detailed analyses.⁵ But in this paper I offer a radical re-appraisal of the standard view as to why Galton assumed such an exposed intellectual position in 1865. In particular, I aim to demonstrate that Galton’s methodology strongly influenced the direction of his hereditarian theorizing and the nature of his biological perceptions. A profound commitment to a statistical approach was

instrumental, I argue, in leading him to adopt the hard hereditarian and highly deterministic positions that characterized both “Hereditary talent and character” and *Hereditary genius*. This interpretation contrasts sharply with most previous accounts in which the nature of Galton’s hereditarianism is identified as arising from an overriding commitment to conservative political values.⁶ Thus, according to Simon Szreter, after 1865 Galton “was almost exclusively interested in social class differentials in British society”.⁷ And Donald Mackenzie has argued that Galton’s hereditarian and eugenic ideologies stemmed from an unconscious compulsion to advance the interests of the “middle class ‘expert’” at the expense of the “priest, aristocrat or plutocrat”.⁸ According to both studies, Galton’s belief in the primacy of heredity affirmed a social structure in which the poor man remained lodged at his master’s gate. Moreover, his disavowal of the inheritance of acquired characteristics is seen as deliberately prejudicial to the Radical’s optimistic belief that the lower classes were amenable to hereditary improvement over time. In excoriating the belief in human perfectibility, Francis Galton was, therefore, a worthy successor of the Reverend Thomas Malthus.

Other scholars have laid greater emphasis on psychological factors; in particular, a personal obsession with relative intellectual performance that Galton acquired as a schoolboy and young adult, having an unfortunate combination of high aspirations and somewhat less grandiose achievements. Raymond Fancher, especially, has shown how this discrepancy powerfully conditioned Galton’s worldview and encouraged him to rationalize intelligence as beyond the control of the individual will.⁹ Finally, several scholars in recent years have stressed the strong affinities between, on the one hand, the deterministic stance adopted by Galton during the 1860s and, on the other, the hereditarian discourses in both the Victorian life-sciences and a wider society deeply permeated with concerns about the integrity of the family lineage.¹⁰

The objective of this article is not to challenge these existing accounts of the role of politics, psychology and intellectual context in the genesis of Galton’s hereditarian thought. On the contrary, it is my belief that only a synthetic account of his thinking is historiographically acceptable. Instead, my aim is to show that the demands attendant on Galton’s insistence on employing a statistical approach exerted at least as powerful an influence on his hereditarian theorizing as the ideas and preconceptions he brought to the study. By neglecting this causal factor, it is my belief that historians have been inclined to accord political and psychological factors undue significance in explaining the development of Galton’s ideas. Yet the importance of this contention is not simply confined to our understanding of Francis Galton. The following analysis may also have a broader relevance to historians and sociologists of science. In this paper, I advance the epistemological claim that historians need to be more aware of how an individual’s reliance on statistical tools may compel the acceptance of beliefs about human nature and society that would seem excessively crude to the researcher under any other circumstances. And whilst this observation applies with particular force to Galton’s work on heredity, it has the

potential to shed light on the careers of many others who have sought to reduce the complexities of human behaviour to statistical regularities.¹¹

More broadly, my account of the origins of Galton's extreme determinism and hard hereditarianism chimes with recent sociological research on the way in which chosen scientific topics may necessitate the adoption of particular methodological approaches. Robert E. Kohler's account of *Drosophila* research is among the most compelling explorations of this theme. Investigating the rationales underpinning Thomas Hunt Morgan's selection of the fruit fly for the investigation of transmission genetics, Kohler shows how this species gained ascendancy over alternative laboratory animals partly because its vigour and fecundity meant that it was pre-adapted to the demands of experimental and laboratory life.¹² Other striking examples include Joan Fujimura's work on "doability" in cancer research and Mitman and Fausto-Sterling's study of Charles Manning Child's research programme on the physiology of inheritance.¹³ In both cases, the team's chosen methodology was intimately bound up with the demands of finding organisms in which specific physiological processes could be studied directly. Furthermore, of course, the choice of methodological tool can in itself condition the way in which phenomena beyond the laboratory setting are perceived. Thus, the self-conscious use of a simplified laboratory model may lead to the largely unconscious adoption of over-simplified notions of how 'nature' works. In view of these observations, my aim in this paper is twofold: first, to show that Francis Galton was obliged to make major concessions to "doability"; and, second, to demonstrate that these had a profound effect on the way he came to regard the role of heredity in human mental development.

Section 1 argues that Galton, as a staunch Darwinian, had a strong *a priori* commitment to the concept of mental heredity. It then reveals that from the moment at which he decided to investigate the heritability of intellect Galton was fully committed to providing a clear quantitative measure of the relative potency of heredity in determining intellectual ability. Section 2 claims that 'proving' mental heredity by statistically analysing pedigrees entailed severe — if not insuperable — empirical difficulties. In particular, Galton struggled to find a credible means of disentangling nature from nurture. Sections 3 and 4 illustrate how these obstacles could only be overcome to Galton's satisfaction only by his contriving a set of congenial theoretical axioms. Foremost among these were the hard hereditarianism and determinism for which Francis Galton is now so (in)famous. In short, this paper shows that formulating the arguments of "Hereditary talent" and *Hereditary genius* demanded that Galton embark upon a largely self-conscious, creative process of fitting his pedigree data onto the Procrustean bed of a numerical approach. Consequently, he should not be portrayed simply as an inflexible ideologue working to 'political' rather than 'scientific' imperatives. In fact, he was also something of a scientific opportunist, seeking to advance his professional status by applying methods to material the complexities of which placed it beyond the very limited tools at his disposal. As to why he persisted in this, Martin Luther's cry "Ich kann nicht anders" seems apposite. Galton too could not "do otherwise" because in his

case anything less than the hardest of hereditarian positions would have meant the abandonment of his entire enterprise. To a significant extent, then, Galton's work embodies conservative political values as a by-product of the methodology he insisted on employing.

1. QUANTIFYING HEREDITY: DARWINISM, EPISTEMOLOGY AND METHODOLOGY

Francis Galton's black 1864–65 notebook makes it abundantly clear that his intellectual *raison d'être* between 1864 and 1865 was demonstrating the veracity of the concept of mental heredity.¹⁴ Perfunctory jottings concerning the social and biological function of religion soon gave way to considerations of hereditary insanity and the hereditary basis of racial "temper", and culminated in rudimentary lists of "distinguished families". Heredity was the unifying concept of virtually all of Galton's notebook reflections, and these betray a studiously selective approach to his source material. His bald references to William Robertson's *History of America*, George Combe's *Constitution of man* and Esquirol's *Aliénation mentale* neglected to mention the stress each author placed on environmental context and biological plasticity in the emergence of racial and/or individual characteristics.¹⁵ Galton's near-exclusive focus on heritability shows that the inheritance of mental attributes became for him something of an *idée fixe* within a very short period after his ruminations began.

Indeed, it is highly probable that Galton was sympathetic to the hereditarian position well before 1864.¹⁶ Moreover, there is convincing circumstantial and documentary evidence to suggest that his desire to investigate the concept of mental heredity in a *scientific* capacity arose directly from the publication of his half-cousin's *Origin of species* in 1859. Above all, it would seem that "Hereditary talent and character" represents Galton's first substantive attempt to fill what seemed to be a major lacuna in the Darwinian's commitment to implicating mankind in the evolutionary process: the inheritance and material basis of man's arguably "special" characteristics. Galton's motivation in this respect was both professional and psychological.¹⁷ By 1863 his existing intellectual pursuits were signally failing to deliver the approbation and public distinction he so earnestly desired. A decade-long involvement with the Royal Geographical Society was under threat because of an acrimonious power dispute with a colleague, Norton Shaw, in which Galton had acquitted himself with very little credit. So prejudiced against him did much of the Society's rank-and-file become that during 1863 steps were even taken to expel him from the Society's Council.¹⁸ Moreover, whilst Galton had also made important contributions to the fledgling science of meteorology, he had come to appreciate by 1863 that the requisite infrastructure was simply not in place to allow this field to flourish.¹⁹

To these 'push' factors were added Galton's keen sense that joining the Darwinian bandwagon might greatly accelerate his rise to the fore of the Victorian life-sciences. As the power of the Darwinian clique increased during the 1860s, he was acute enough to sense that his kinship to Charles Darwin (he was Darwin's half-cousin)

alone might lubricate his ascent into the highest ranks of what was already promising to become a potent scientific force. Against this backdrop, during the first years of the 1860s Galton struggled to locate a scientific niche that was conducive to the Darwinian enterprise at the same time as being original and significant. At first he experimented with a detailed analysis of the circumstances militating in favour of the domestication of certain animal species; a study that was obviously germane to Darwinism and that he richly embroidered with mentions of natural selection.²⁰ Yet, despite some earnest Public Relations, the resultant article failed to pique his half-cousin's interest.²¹ Galton responded by quietly shelving the subject of domestication and his search for a conducive scientific project resumed.

In 1864, innervated by his growing involvement with the Ethnological Society, Galton then reoriented his focus to the more high-risk and high-gain area of human evolution. As his black notebook shows, having embarked on a study of inborn racial characteristics, his attention was drawn after a few months to the question of heredity *within* populations and the pedigrees of his own countrymen. Aside from its implicit importance to the Darwinians — illustrated by the extremely positive reception of *Hereditary genius* by Darwin and Alfred Russel Wallace — there are several other reasons why Galton made this shift from race to family.²² First, he is likely to have been directly inspired by the discussion of pedigrees and the inheritance of genius contained in G. H. Lewes's *The physiology of the common life* which he read sometime towards the end of 1864. Second, his combined fascination for mental heredity and pedigree accords with the premium placed upon good marriages and intellectual achievement among his élite social stratum of highly-accomplished professionals. Third, in complex ways his commitment to mental heredity drew upon a set of élitist sociopolitical values that emphasized birth over education. Finally, gnawing worries about his own intellectual capabilities, combined with the experience of often working himself to breaking point but rarely making the first grade of intellectual achievement, persuaded him that intellect is largely foreordained. These factors, and presumably many more, coalesced during the mid-1860s to convince Galton that the heredity of intellect was one of the most pressing scientific issues of his day with the bonus of having an immediate and obvious pertinence to debates about man's place in nature.²³

Just as emphatically, Galton's black 1864–65 notebook also shows us that he quickly became committed to the blend of epistemology and methodology that would be the touchstone of his entire scientific career: statistical science. Galton was well aware that most of his intellectual originality derived from this approach rather than from his subject-matter or his findings. In *Hereditary genius* he admitted that his innovation lay in treating “the subject [of mental heredity] in a statistical manner, to arrive at numerical results”.²⁴ This devotion to statistics had deep roots. Galton was raised in a highly mathematical household and by adolescence, as a medical apprentice at the General Hospital Birmingham, he seems to have been most comfortable investigating natural phenomena with the aid of statistical data.²⁵ At Cambridge University, Galton at first delighted in the tutelage of the famously

skilled mathematics coach William Hopkins. And whilst a nervous breakdown, brought on by excessive pressure and overwork, meant that he left Cambridge without Honours, Galton's fascination for quantification was hardly diminished.²⁶ Accordingly, the journals he kept when exploring in Africa between 1850 and 1852 contain a wealth of anecdotes in which his numerical fastidiousness assumed occasionally absurd proportions. Ascertaining the vital statistics of a Hottentot "Venus" with the aid of sextant and compass, and counting every brush stroke made by his portrait painter, suggests a propensity to measure and count bordering on the pathological.²⁷

Francis Galton's predilection for quantification is also symptomatic of the high status numeracy was achieving in a nation that set great store by precision measurement in industry, and in which the government's appetite for demographic statistics was fast growing.²⁸ Further, during the seven years prior to writing "Hereditary talent and character", he was studying meteorology at Kew Observatory, which has been described by Theodore Porter as "probably the leading institution of statistical meteorology in the world"; and by the early 1860s he was already a member of the Statistical Society of London.²⁹ At the same time, Galton was emerging as an active human scientist. By the 1860s, applying numerical scales to the human mind, producing aggregate population scores and making statistical comparisons were far from novel exercises. Galton may have been abused by the *Spectator* for applying statistics to "moral influences", but anthropometry, craniology and phrenology had carved out a large space for this form of inquiry decades before 1865.³⁰ Consequently, as early as his exploration of Damaraland in Southwest Africa between 1850 and 1852, Galton was calculating facial angles according to Petrus Camper's late eighteenth-century techniques, and employing them as indices of intelligence.³¹ Moreover, as a major player in the Ethnological Society from the early 1860s, he was regularly exposed to the use of physical measurements in studying the human mind.³² The works of Paul Broca, James Hunt, Robert Knox and Charles Carter Blake would all have been familiar to him.³³

But in broaching the question of mental heredity there were additional, more proximate, reasons why Galton should have adopted a statistical methodology of the form that he did. The first substantive mention of lineages among his 1864 notes concerns a pilot study of the interrelationships of eminent Chancellors drawn from a biographical dictionary.³⁴ Even at this early stage he was seeking clear numerical results that neatly divided causality into discrete quantities and submerged local disorder beneath general principles. Naturally, such an undertaking immediately ruled out the qualitative form of most existing statements as to the origin of intellectual variation. And from the beginning it is clear that Galton was not willing to confine his work on heredity to imposing arbitrary boundaries between nature and nurture, or vaguely remarking that both are important factors. At the same time, he recognized that there were very few ways of advancing upon the unsatisfactory evidence for mental heredity adduced by his contemporaries and

predecessors: relevant physiological data were unobtainable, and this was not an issue that purely abstract philosophical reasoning was likely to penetrate.

Applying statistical methodology to pedigree data was the only means of bringing any precision to the debate as to the origin of intellectual variation. Earlier medical writers had also produced lists of talent “clinging to pedigrees” and at least one of these is likely to have strongly influenced Galton.³⁵ Nevertheless, their methods were unsatisfactory because they always involved the deliberate selection of a handful of eminent pedigrees, and made no attempt to determine the proportion of *all* eminent men with talented ancestors and predecessors. G. H. Lewes’s 1860 list was typical in this respect:

Bernardo Tasso was a considerable poet, and his son Torquato inherited his faculties heightened by the influence of the mother. The two Herschels, the two Colemans, the Kemble family, and the Coleridges, will at once occur to the reader; but the most striking example known to us is that of the family which boasted Jean Sebastian Bach as the culminating illustration of a musical genius, which, more or less, was distributed over three hundred Bachs, the children of various mothers.³⁶

The methodological shortcoming involved in such compilations was clear to several of Galton’s contemporaries. Indeed, elsewhere it was also obvious to Lewes himself. Writing in the *Westminster review* of 1857, he mocked the febleness of the approach he subsequently adopted:

Even the man of letters is not without his generalization on the transmission of genius ... in support of which ... he counts upon his fingers the illustrations which occur to him, perfectly heedless of the mass of cases in which the [progenitors] have not been remarkable.³⁷

More damning by far was the pioneer sociologist Henry Buckle’s assertion in his 1857 *History of civilisation*, that ‘evidence’ for the hereditary transmission of disease and psychical attributes is simply the result of coincidence:

We often hear of hereditary talents, hereditary vices, and hereditary virtues; but whoever will critically examine the evidence will find that we have no proof of their existence ... in all large fields of inquiry there are a sufficient number of empirical coincidences to make a plausible case in favour of whatever view a man chooses to advocate.³⁸

Galton encountered Buckle’s blistering attack in Lewes’s *The physiology of the common life*, in which the above passage was reproduced verbatim, and thereafter it must have preyed heavily on his mind.³⁹

Indeed, Galton very soon realized that any appearance of selectivity was fatal to the argument he hoped to make, and he earnestly distanced himself from the crude analyses of his predecessors. From 1865 onwards, he stressed that his lists of eminent men had been drawn from published or well-recognized compendiums produced by third parties and without the slightest regard for illustrating the primacy

of heredity. He was equally aware of the fact that previous authors had failed to demonstrate that the levels of intellectual ability they were dealing with were sufficiently *uncommon* to justify curiosity when they recurred in a single lineage. He fully appreciated that a convincing proof of mental heredity needed to show that parents and children share similar levels of intellectual capacity to an extent *incompatible* with chance processes. This statistical means of invalidating Buckle's critique would have been entirely obvious to Galton through his acquaintance with conventional statistical methodology. If he needed a reminder, the *Origin of species* provided all the statistical understanding he would have required. "When any deviation of structure often appears, and we see it in the father and child", Charles Darwin observed in 1859:

we cannot tell whether it may not be due to the same cause having acted on both; but when amongst individuals, apparently exposed to the same conditions, any very rare deviation, due to some extraordinary combination of circumstances, appears in the parent — say, once amongst several million individuals — and it reappears in the child, the mere doctrine of chances almost compels us to attribute its reappearance to inheritance.⁴⁰

Accordingly, Galton opened *Hereditary genius* with an assessment of the statistical frequency of genius. Analyses of obituaries and books of eminent men gave him a figure of 250 per million, which allowed him to claim that the probability of two geniuses being found in a single lineage was astronomically small unless one invoked a common underlying cause, e.g. hereditary transmission.

Finally, and more generally, Galton perceived in the adoption of a statistical methodology a crucial advantage for studying processes as capricious as the alleged transmission of mental traits. By concentrating upon averages, disregarding 'outliers' and burying eccentricities beneath mean scores, he could elude many of the problems that had confounded his predecessors. It was no longer troubling that a certain eminent statesman or judge had given rise to an unbroken line of congenital idiots, so long as there were a reasonable number of negating counter-examples. Galton was able to assert the omnipotence of heredity only because his study involved an unprecedentedly large number of individuals; and instead of representing a deliberate selection of eminent men, his analyses encompassed entire biographical dictionaries. As he explained in his 1865 article, "Hereditary talent and character":

So long as we have a plenitude of evidence in favour of the hypothesis of the hereditary descent of talent, we need not be disconcerted when negative evidence is brought against us.... All I can show is that talent and peculiarities of character are found in the children, when they have existed in either of the parents, to an extent beyond all question greater than in the children of ordinary persons.⁴¹

Though Galton indifferently conceded the "fact, neither to be decried nor to be considered of importance, that the children of men of genius are frequently of

mediocre talent”, as far as he was concerned, no one could realistically gainsay the significance of his calculation that one in six of the notable persons included in Sir Thomas Phillips’s compilation *The millions of facts* were somehow related: “the overwhelming force of a statistical fact like this renders counter-arguments of no substantial effect.”⁴²

It is worth mentioning that one striking feature of Galton’s statistical approach between 1865 and 1874 is that his application of the normal distribution was methodologically facile.⁴³ His early studies were actually distinctive, first, because his data-set was (largely) unselectively compiled and, second, because he began by calculating the supposed frequency of genius. These methodological advances underscore the fact that Galton was absolutely determined to achieve numerical regularity and would brook no ambiguity in his results. He had self-consciously fashioned a methodology that answered the objections of Lewes and Buckle, and at this stage his method was as robust as it could have been. However, now that he was ready to turn to the pedigree data itself new and more serious problems presented themselves; and these would have profound implications for his construction of the theoretical stance of “Hereditary talent and character”.

2. THE PROBLEMS WITH PEDIGREE DATA

The more incisive of Galton’s critics questioned the very plausibility of interpreting pedigree data in terms of hereditary transmission. Disdaining Galton’s discussion of heredity among judges, a reviewer in the *Scotsman* observed, “It may be very fairly remarked that education in a forensic atmosphere, combined with habits of application, have had a good deal to do with some of the instances in which a son has succeeded his father on the judicial bench”.⁴⁴ Such remarks partly reflect the fact that many intellectuals were distrustful of statistical methodologies. More importantly, most mid-Victorians deemed the value of education and opportunity in determining individual achievement too mundane a truth to be disputed. In contrast to Galton, the majority of reviewers confidently subscribed to an inclusive view of the development of human intellect that saw education operating to enhance or suppress variable hereditary endowments. The *Edinburgh review* noted that although it was perfectly reasonable to claim that certain individuals belong to hereditarily “clever” families, “Nothing is clearer than that the children of clever persons have advantages over others in the way of education, emulation, conscious and unconscious imitation, which are quite different from any supposed tendency in the blood itself”.⁴⁵ J. S. Mill summed up this standard view in his classic riposte to Thomas Carlyle’s nativism. Trees may come from the same parent stock, he observed, but “is nothing to be attributed to soil, nothing to climate, nothing to difference of exposure?” Insisting on the infinite variety of “accidents and external influences” that determine man’s mental development, he condemned “The vulgar error of imputing every difference [one] finds among human beings to an original difference of nature”.⁴⁶ Although, in some of their sociopolitical attitudes, Mill and many other leading liberals were *implicitly* anti-egalitarian,⁴⁷ such sentiments rarely

surfaced in their specifically intellectual discourses.

Newspaper and journal reviewers also criticized Galton for having apparently overlooked the importance of preferment and Old Corruption in determining individual fame. Few were hostile to the idea of intellectual capacity being to some extent foreordained, but they took exception to Galton's presumption that a lack of social connections is seldom enough to repress able men. The *Times*, for instance, applied Galton's insights to the life of John Keats and found them seriously wanting. "His greatness", the reviewer claimed, "like all others, was the accident of an accident ... a number of felicitous circumstances must have concurred to allow his genius to assert itself".⁴⁸ In the same vein, several writers invoked the reasoning of Thomas Grey to claim that only those both talented from birth *and* born to well-placed families could have a reasonable expectation of achieving their 'rightful' social position. Along similar lines, the *Scotsman* hinted at a rival explanation for Galton's pedigree data: "The presumed talent existing among the relations of eminent lawyers may", the reviewer wrote, "become a very convenient answer to the accusations of jobbery and nepotism so often preferred against Lord Chancellors and other high law officers".⁴⁹

Clearly, in 1865 and 1869 Francis Galton set himself a near-impossible task: there were quite simply no satisfactory means of disentangling the effects of circumstances and heredity from pedigree data. Statistically separating these two distinct yet complementary strands of causation was beyond the scope of scientific analysis. As the *Scotsman's* reviewer astutely explained:

The fact is, the elements which go to make up the complex organisation of man are too various and conflicting for analysis such as that before us, and are of a kind incapable of being brought to the empirical test of statistics like Mr. Galton's.⁵⁰

Genealogical evidence for the continuity of professional or artistic success in lineages is equally supportive of the importance of heredity, of education and of inequitable opportunities in determining the level of an individual's achievements. Except in rare circumstances, data suggesting the importance of education and preferment are *identical* to that for hereditary transmission. Furthermore, even if one manages to isolate weakly the effects of nature and nurture, there is still the problem that the relative importance of these factors will vary enormously between generations and among different lineages.

In turn, these difficulties suggest two others. First, Galton lacked any formal algorithm for determining intellectual ability. How could he possibly hope to calculate inborn ability where psychometric tests were as yet unconceived?⁵¹ Second, even if one accepted the hypothesis that education is less important than heredity, statistical evidence for continuity in intellectual performance across generations is meaningless unless it can also be convincingly shown that the probability of a randomly selected member of the population achieving a very high intellectual level is extremely small. The frequency of genius has to be very low for Galton's method to be credible. As he jotted in a notebook draft for *Hereditary*

genius: “The proof that genius is hereditary is that very able men are commonly related, but this evidence is cogent only in so far as it can be shown, that very able men are great rarities.”⁵² Yet Galton could not easily make this assumption. Even if high ability often were a matter of heredity, social obstacles might well have the effect of suppressing the rise to eminence of scores of lowborn geniuses. This would imply that eminence only *seemed* a rare phenomenon because of the severity of social constraints upon upward social mobility. Indeed, if genius actually were a relatively common phenomenon but social factors prevented its expression, then Galton’s pedigree data would be doing no more than providing powder for the Radical’s guns.

In short, for a variety of reasons, Galton’s application of the normal curve to the question of human intelligence was in danger of illustrating only the effectiveness of power, capital and ‘jobbery’ in differentiating the classes of Victorian society. Almost anyone seeking to evince mental heredity statistically would have recognized the existence of these problems and most would have abandoned the project as beyond the pale of scientific analysis. But as a determined positivist and, even more so, an ambitious Darwinian, Galton pressed on regardless. Over the course of half a decade he managed to devise a set of axioms that, to his satisfaction at least, circumvented methodological difficulties that most of his predecessors had always considered impassable.

3. EDUCATION AND OPPORTUNITY

Francis Galton concluded the second chapter of *Hereditary genius* with the comment, “I feel convinced that no man can achieve a very high reputation without being gifted with very high abilities; and I trust that reason has been given for the belief, that few who possess these very high abilities can fail in achieving eminence”. He preceded this assertion with an equally contentious statement:

People are too apt to complain of their imperfect education, insinuating that they would have done great things if they had been more fortunately circumstanced in youth. But if their power of learning is materially diminished by the time they have discovered their want of knowledge, it is very probable that their abilities are not of a very high description, and that, however well they might have been educated, they would have succeeded but little better.⁵³

These were extraordinary claims and few of his reviewers passed over them without the severest criticism.⁵⁴ Galton was not, however, personally accused of providing a legitimization of inequality. Instead it was generally felt that he had become carried away with his theory, or his “hobby-horse” as one reader aptly termed it in the *Daily news* of 1869.⁵⁵ This contrasts strongly with several recent accounts in which Galton’s purblindness is ascribed to a set of political predilections.⁵¹ These historians assume that, in grossly under-emphasizing education and opportunity, Galton was doing *no more* than articulating basic components of his political worldview. This interpretation, however, demands qualification. It

should become apparent below that the dogmatism of his case between 1864 and 1869 had as much to do with practical necessity as either intellectual or ideological preconceptions.

Looking back to the previous decade in 1876, Galton confessed to having “heartily felt” the need for reliable “criteria” with which he could separate “nature from nurture”. He explained that despite having “tried many methods”, the objection could always be raised that “You take insufficient account of the influence of education and opportunities, which are enjoyed by the class of successful men more largely than by the class of nobodies”.⁵⁷ Such remarks underscore the self-conscious manner in which Galton struggled against unavoidable empirical difficulties. That he wrestled with the problems enumerated in the previous section in a deliberate and self-reflexive fashion is also clear from the tortuous way in which he constructed the axioms of “Hereditary talent” and *Hereditary genius*.

The crux of the matter is that by 1864 Galton knew that in order to subject the hypothesis of mental heredity to proper statistical analysis, and do more than recapitulate the existential and anecdotal evidence utilized by his predecessors, he was compelled to deny that *criteria for separating nature from nurture were even required*. Galton could not admit that heredity and environment are both important factors without closing off any possibility of a quantitative analysis. His solution was to find a category of person for whom education, preferment and nepotism could be adjudged *a priori* as having inconsequential effects. Only having established axioms supportive of this position would Galton then be entitled to analyse his pedigree data without the slightest regard to extraneous factors. Clearly, this is a very long way off from the concept of ‘broad heredity’ that underlies most modern attempts to disentangle the relative importance of heredity and environment. One hundred and forty years ago, the statistical methods to permit the calculation of broad heredity were unavailable. In these fraught circumstances Galton was trying to devise a set of theoretical justifications that would allow him to model the heritability of intelligence more rigidly than we can now describe the highly predictable inheritance of eye and skin colour. This was obviously going to be a very tall order. But it was Galton’s only option. How he managed to formulate suitable axioms is the subject of the following sections.

3.1. *The Formulation of “Hereditary Talent and Character”*

In mid-1864, as his black notebook indicates, Galton was explicitly searching for a means of separating nature and nurture, though at this stage he was concerned only with the “peculiarities of different races”.⁵⁸ His first breakthrough was to see that aboriginal populations often share physical and psychical attributes even though they inhabit highly *dissimilar* geographical and climatic regions.⁵⁴ For Galton, this evidence of a disjunction between racial type and environmental context unambiguously revealed the inherited characteristics of human races. If climate and means of subsistence did not explain bodily form and mental performance, then only the heritable properties of race could. In his notebook he jotted, “The many

independent communities in America having common qualities show that this is due to nature & not to tradition".⁶⁰ In "Hereditary talent and character" he made the basis for this approach even more explicit, as involving the observation of "several individuals of the same race, reared under various influences, and noting the peculiarities of character that invariably assert themselves". His earlier remark on the American Indian was then fleshed out into the following passage:

The race of the American Indians is spread over an enormous area, and through every climate; for it reaches from the frozen regions of the North, through the equator down to the inclement regions of the South. It exists in thousands of disconnected communities, speaking nearly as many different languages. It has been subjected to a strange variety of political influences, such as its own despotisms in Peru, Mexico, Natchez, and Bogota, and its numerous republics, large and small. Members of the race have been conquered and ruled by military adventures from Spain and Portugal; others have been subjugated to Jesuitical rule; numerous settlements have been made by strangers on its soil; and, finally, the north of the continent has been colonized by European races. Excellent observers have watched the American Indians under all these influences, and their almost unanimous conclusion is as follows: The race is divided into many varieties, but it has fundamentally the same character throughout the whole of America.⁶¹

The complete isolation of heredity seemed to be a credible objective after all. A little imagination and it was possible to identify natural 'experiments' already underway that could provide him with the data he needed. It was probably in this period that Galton also devised a plan for questioning the heads of colonial orphanages as to how closely the characteristics of individual children in their care deviated from the mental qualities of the tribes into which they had been born and soon after abandoned. If, despite growing up among many other races and tribes, the children exhibited typical racial traits (e.g. stubbornness, petulance, slavishness), then he had further evidence for the primacy of heredity.⁶² Clearly, then, Galton was stretching his imagination in seeking ways of making a statistically cogent case for the inheritance of mind. To repeat: far from being blinded by political preconceptions, he was acutely aware of the extreme technical difficulties he faced.

Soon after, when Galton abandoned his ethnological study and turned to intra-specific comparison, his search for methods fully to disentangle nature and nurture continued unabated. Once he had seized upon pedigree analysis he was faced with the choice of which section of the social or intellectual hierarchy to focus upon. He elected to study the interrelationships of the eminent partly because their lives were well documented, their inclusion was based on the judgement of posterity rather than a personal selection, and the data-set was sufficiently small and well-delimited for a few weeks of compilation to produce results. Yet, Galton fully recognized that he was courting subjectivity by relying entirely upon reputation as a measure of natural ability. In a telling passage from his 1868–69 notebooks he explained

that he had “thus far endeavoured to discuss the degree in which fame is a test of ability”, and far from simply accepting the validity of this evaluation, he candidly admitted to himself that it was “the only test that I can supply”.⁶³ Equally, Galton was fully cognisant of the existence of social barriers to upward social mobility. In “Hereditary talent and character” he explained:

It is justly to be urged, in limitation of the enormous effect of hereditary influence ... that when a parent has achieved great eminence, his son will be placed in a more favourable position for advancement, than if he had been the son of an ordinary person ... it is notorious that neither the Legislature nor the army afford, in their highest ranks, an open arena to the ablest intellects. The sons of the favoured classes are introduced early in life to both these fields of trial, with every encouragement to support them. Those of the lower classes are delayed and discouraged in their start; and when they are near the coveted goal, they find themselves aged. They are too late: they are not beaten by the superior merit of their contemporaries, but by time; as was once touchingly remarked by Sir De Lacy Evans.⁶⁴

Despite the reservations occasioned by such considerations, by late 1864 Galton had accepted reputation as his index of native ability. As he himself admitted, he had little alternative. In the following weeks and months he then toyed with several different ways of excluding extraneous influences from his data-set of eminent pedigrees. “Hereditary talent and character” would emerge in all its flawed finery from this period of intense and creative rumination.

Galton began “Hereditary talent and character” by providing extensive pedigree evidence that genius “clings to families” in a very high proportion of cases. As we have seen, this left him with the extremely daunting task of proving that social advantages could not possibly explain this correlation. He based his alternative hereditarian explanation on three fundamental claims. The first was that success recurs in family lines just as much in “the more open fields of science and literature” as in the apparently less meritocratic spheres of politics and the army. Notwithstanding his earlier statement about the scale of nepotism in the higher ranks of the Legislature, he added, “The Law is, by far, the most open to fair competition of all the professions”. And since over a third of Chancellors since the reign of Henry VIII were closely related to one another, he reasoned that heredity is surely even more important than anyone had ever previously imagined. Francis Bacon may have stated that “genius has no continuance”, but his own pedigree gave the lie to this.

Galton buttressed his first claim with another. He insisted that wealth and education so often produce indolence and *ennui* in their recipients that one could hardly consider the possession of either to be at all beneficial. He continued:

Whatever spur may be given by the desire to maintain the family fame, and whatever opportunities are afforded by abundant leisure, are more than neutralised by those influences which commonly lead the heirs of fortune to idleness and dilettantism.⁶⁵

This assertion was always going to look like special pleading, and it was unceremoniously dropped before the writing of *Hereditary genius* four years later. Lastly, anticipating an argument he would develop much more fully over the following years, he reflected with characteristic reverence on the performance of the highest achievers in the Cambridge Classics Tripos:

The senior classic at Cambridge is not only the foremost of the 300 youths who take their degrees in the same year, but he is the foremost of perhaps a tenth part of the classical intellect of his generation, throughout all England. No industry, without eminent natural talent to back it, could possibly raise a youth into that position.⁶⁶

Here we see the primary strategic reason for Galton's decision to study heredity among eminent men: some were so extraordinarily accomplished that it seemed unrealistic to ascribe their success to a set of environmental factors they shared with virtually all of their peers — Galton included. Moreover, as he went on to observe, almost a third of the senior Classicists were closely related to another of their kind.

It was on the basis of these manoeuvres that Galton felt that he had removed extraneous influences from the equation in 1865. This left him free to interpret all his pedigree data — whether applying to generals, lawyers or poets — in terms of hereditary transmission alone. Not only that, but he had handed Charles Darwin evidence of mental heredity that his kinsman would cite with confidence in both *Variation of animals and plants under domestication* and the *Descent of man*.⁶⁷ After 1865, then, Galton had at last qualified for inclusion within the Darwinian coterie. But now that his principal aim had been achieved, he found himself having to defend his cleverly contrived hereditarian position from often vigorous attack. Necessity had forced him to take an extreme line: he was now in the rather uncomfortable position of having to defend it.

3.2. Hereditary Genius *and a Second Try*

Between late 1865 and 1869 it is apparent that Galton was still spending much of his time engaged with the nature–nurture problem, and he came to precisely the same conclusion as before: the effects of nurture had to be belittled, if not entirely rationalized away. Yet he also recognized that he would have to improve substantially upon his 1865 effort. In the introduction to *Hereditary genius* he admitted that the ideas expressed in “Hereditary talent and character” had been “in contradiction to general opinion”, and the criticisms he had presumably elicited go a long way in explaining why his later publication was much more sophisticated and theoretical in its treatment of the nature–nurture dichotomy.⁶⁸

A fascinating snapshot of how Galton was beginning to visualize the nature of intelligence at this time is provided by a manuscript draft of *Hereditary genius* in which he discussed in detail the significance of education in forming the minds of the eminent. Tentatively presenting a rudimentary model of the relationship

between nature and nurture, he wrote:

Education (I use the word in its largest sense) will develop some faculties at the cost of the rest ... the total neutral energy being perhaps but little altered. The prodigious memory of a lawyer in respect to legal decisions ... surpasses the performance of a much higher genius whose mind has been wholly uneducated in those respects.⁶⁹

Thus, education can only determine which of numerous pre-existing cerebral channels become highly developed and which remain comparatively inchoate. Education might decide which field individuals enter but not how well they will perform therein; success itself is contingent upon the fixed quantity of “mental energy” that an individual inherits.⁶⁵ Conceptualizing intelligence as a closed system of energy flows enabled Galton to posit extreme hereditarianism whilst seeming to be sensitive to environmental context. As a metaphor, his notion of “mental energy” (presumably derived from nineteenth-century thermodynamics) allowed him to picture a physiological substrate to his hereditarian model. Despite this, and whilst it clearly aided and informed his thinking, the model was omitted from the published version of *Hereditary genius*. The basic assumptions underlying it, however, were spotted by at least one perceptive reviewer: the *Morning post* observed that eminence for Galton is “an innate something which is shaped into intellect, as a bar of iron is hammered into the form of a horseshoe”.⁷¹

Moving back to the world of mathematical regularities with which he felt more comfortable, in January 1869 Galton published a little-known paper as a dry-run for *Hereditary genius*. In an article also entitled “Hereditary genius”, he revealed a brand new formula for isolating nature from nurture:

The appearance of the man of highest ability in a family should not be an abrupt and isolated phenomenon, but his ability should be built up, so to speak, by degrees, in his ancestry; and conversely, it should disperse itself by degrees in his descendants.⁷²

To Galton’s satisfaction, this is exactly what he claimed to have found. His rationale was that whilst generation after generation may receive a first-rate education — implying that intellectual attainments should remain fairly stable over the course of generations — the units of heredity could never flow so consistently. Rather, the finite supply of units producing high intellectual ability would be distributed among the offspring of genius making each generation progressively less intelligent as the original suite of germs became increasingly diluted. Galton would use evidence of this pattern again in *Hereditary genius*, but as an attempt to demarcate the effects of heredity it was far from effective because the results could equally be explained in terms of the accumulation and then dissipation of family fortunes. Stories of self-made men having their hard-won wealth squandered by effete and indolent sons were already common currency in Victorian Britain. So whilst this point was typically ingenious, he seems to have realized that it could not be expected to carry

the entire weight of his argument.

In the book *Hereditary genius*, published soon after, Galton advanced three further bases for the primacy of nature over nurture. To these he would remain committed. First, the alleged fact that America's ostensibly egalitarian society produces fewer born geniuses than Britain's class-ridden culture. Second, the mediocrity of the cousins of Popes corruptly elevated into important ecclesiastical positions but sharing only a fraction of the Papal "genetic" heritage. Third, his 1865 claim, which he developed in considerable detail that education cannot be of great benefit to the truly brilliant. This last argument requires further elaboration since its construction clearly illustrates the way in which empirical demands shaped Galton's biological perceptions. It was an argumentative strategy that involved making a potential weakness in his case into an apparent source of strength. In *Hereditary genius* it became his chief means of evincing his claim that "high reputation" is an "accurate test of high [inborn] ability".⁷³

Galton's earliest investigations had forced upon his attention the impressive proportion of eminent men who had emanated from the humblest of social groups; most notably, Lord Brougham, Jean Jacques Rousseau, Jean le Rond D'Alembert, and even his master at Trinity College Cambridge, the polymath William Whewell. The tremendous upward social mobility of these men had given them such iconic stature that no study of the origins of intelligence could reasonably exclude them. Dealing with such individuals, Galton might have seemed to be at an *impasse*. He must have been aware that Charles Lyell had made great play of the "birth of an individual of transcendent genius, of parents who have never displayed any intellectual capacity above the average standard of their age or race" in his *Antiquity of man*.⁶⁹ Indeed, the *Scotsman's* reviewer triumphantly seized upon this as the Achilles heel of Galton's argument: "Where genius is most transcendently manifest, in our Shakespeares, Miltons, Cromwells, we are absolutely at a loss for any traces either of descent or transmission."⁷⁵

However, unbeknownst to the *Scotsman's* critic, Galton was using the very fact of social mobility to assert the dominance of nature over nurture. In *Hereditary genius* he candidly admitted that social hindrances might repress men of "mediocre talent". As he wrote in a notebook of 1869, a lack of education inevitably arrested the social progress of many individuals:

The want of education is a serious lack to ordinary men whose receptive faculties become sluggish after youth and who during boyhood and youth are not goaded [into] learn[ing], and have no great facility in absorbing and assimilating information.⁷⁶

But, the very fact that a few singular individuals had sailed over all social hurdles whereas the overwhelming majority of their peers had barely left the starting blocks, enabled Galton to argue that there was something very special about these men. Crucially, they allowed him to ask the rhetorical question: how could education be considered imperative for their intellectual development when these

men had enjoyed no formal education at all? The likes of Whewell and Brougham seemed to have almost effortlessly surpassed the many thousands of their *well-born* contemporaries who had had up to two decades of formal education lavished upon them. In view of this, though there were obvious problems in doing so, Galton interpreted their apparently irrepressible rise to eminence as proof of their enjoying a highly fortuitous *biological* inheritance. Presumably realizing how exposed this position was, he manoeuvred to suppress a probable objection:

Most persons seem to have a vague idea that a new element, specially fashioned in heaven, and not transmitted by simple descent, is introduced into the body of every newly-born infant. Such a notion is unfitted to stand upon any scientific basis with which we are acquainted.⁷⁷

In other words, because this alternative violated the scientist's *raison d'être* of searching for fundamental and universal laws, hereditary transmission was the *only* viable explanation for low-born genius.

Having invoked the authority of positivist science itself, Galton was content to proceed. The lowborn genius, he continued, proved that genius will always manifest itself, irrespective of extraneous factors. If neither Brougham nor Whewell could be kept down then what was to stop any other genius from rising to the top of the pile? The central feature of this definition of genius was that “the hindrances of English social life, are not effectual in repressing high ability”.⁷⁸ Had history's eminent men been “changelings when babies”, he went so far as to insist, “a very fair proportion ... would have equally risen to eminence”.⁷⁹ So Galton was not claiming that all levels of intelligence are equally hereditary, but that genius represents an extreme form of ability in both literal terms and with respect to ontogeny. In fact, it would seem that he found the confidence to write on hereditary intelligence for the second time only because he felt that he had identified a sub-population that could be considered without reference to “complicating” — i.e. environmental — factors. As he wrote in his red notebook of 1869: “Very high reputation is a safe indication of very high ability; the less high the reputation the more uncertain is the value of reputation as a test.” “We” reduce the “errors of commission”, he confessed, “when we confine ourselves to men who have attained the highest degree of fame”.⁸⁰

For entirely pragmatic reasons, therefore, by 1869 Galton had abandoned the attempt to evince mental heredity for all but about the top two per cent of his normal distribution. By restricting his study in this way he hoped that the public would accept his profoundly tautologous definition of genius: “a man of such brilliance that he cannot be kept down by social obstacles.” Paradoxically, however, an exercise that had proceeded from the assumption that genius is just the top end of a normal scale of intelligence ended by setting it up as a form of intelligence in some ways *qualitatively* different from all others. The very attempt to analyse statistically the heredity of genius had resulted in Galton changing his perception of the phenomenon itself.

More importantly, the rationalization that education and contacts are irrelevant to the lowborn genius also enabled Galton to claim that eminence was as singular a phenomenon as it seemed, and as rare as his method required it to be. If there are no social barriers to the rise of the genius, then biographical dictionaries contain the vast majority of the brilliant men that have ever lived and survived long enough to make their mark. The significance of familial continuity in talent was thereby confirmed and his statistical method fully vindicated. Thus, in the opening sections of *Hereditary genius*, Galton's discussion of the lowborn genius provided evidence that for those who had risen through the ranks without the benefit of education and propitious circumstances, heredity could be studied in an unleavened form.

Yet Galton clearly understood that his main thesis would be largely confined to the statistical investigation of illustrious lineages that, almost by definition, were extremely privileged socially. Indeed, his argument would hardly have been helped by accumulating masses of data showing that most geniuses had, as was once said of the political commentator David Frost, "risen without trace". Galton circumvented this difficulty in an imaginative — albeit deeply flawed — manner. As we have seen, he took the intellectual level reached by extraordinarily socially mobile individuals to define the natural limits of human capacity in any one generation. Since they had succeeded where men with ability *as well as* education and greater opportunities had failed, Galton felt justified in concluding that they occupied and defined a category of intelligence *sui generis*. Without making the next step explicit, he then also placed the well-born individual who had achieved eminence into the same category. In this way, the upwardly mobile genius provided the key to disposing of the basic problem of distinguishing between the effects of heredity and circumstance within Galton's entire data-set. If social hindrances and want of education did not seem to retard the humble-born genius, he rather tortuously reasoned, these factors could hardly be deemed *beneficial* to the *well-born* intellect of the highest intellectual grades. These grades therefore came to represent, for Galton, a discrete category of men, conjoined by the assumption that a well-born and eminent individual profited from the education foisted upon him no more than his lowborn intellectual peer suffered by its absence. Accordingly, Galton argued, a young man destined for the highest grades does

not want a master continually at his elbow to explain difficulties and select suitable lessons.... The best care that a master can take of such a boy is to leave him alone, just directing a little here and there, and checking desultory tendencies.⁸¹

So long as the born genius is also equipped with "zeal and power of work", Galton concluded, social factors may slow down but never repress their achievement of immense social distinction.

Only the most conscientiously inegalitarian of Galton's contemporaries would have approved of the way in which these basic axioms were constructed, but so

counter-intuitive did the more explicit claims of the book seem that few expended the effort required to consider the empirical reasons why Galton had assumed such an extreme position. The majority would unquestionably have assumed that those who achieve distinction but also enjoy formal education and are well connected, require a *lesser* biological endowment in order to achieve eminence. Galton acknowledged and rather casually dismissed this view in his 1874 *English men of science*:

It is by no means the case that those who have raised themselves by their abilities are found to be abler than their contemporaries who began their careers with advantages of fortune and social position.⁸²

Still more would have rejected his assumption that because Whewell, Rousseau and Faraday had risen through the ranks, *all* those with considerable natural ability had also managed to do so. The apparent ease of social mobility in a few cases was not generally seen to contradict the belief in numerous mute inglorious geniuses buried in obscure hamlets. In the words of one reviewer, for every man who escaped his humble origins:

A hundred, perhaps not inferior in natural gifts, fail and perish by the way. Like the seed of the sower, much of it falls on rocky ground. "The world has never known its greatest men".⁸³

But Galton had no choice in adopting axioms that would stimulate the wrath of the Victorian Radical. Out of necessity, he had self-consciously provided an illogical antithesis to Gray's elegy. And, as we shall see, in the interests of "doability", the same pragmatic considerations would also determine Galton's attitude towards use-inheritance or the inheritance of acquired characteristics.

4. THE INHERITANCE OF ACQUIRED CHARACTERISTICS

According to the Darwinian George John Romanes, there was "virtually identity" between Galton's hard hereditarianism and Weismann's theory of the continuity of germplasm.⁸⁴ Consistent with this interpretation, in "Hereditary talent and character" Galton argued that "Everything we possess at our birth is a heritage from our ancestors". And he elaborated:

I cannot ascertain that the son of an old soldier learns his drill more quickly than the son of an artizan. I am assured that the sons of fishermen ... are just as sea-sick as the sons of landsmen when they first go to sea.... If the habits of an individual are transmitted to his descendants, it is, as Darwin says, in a very small degree, and is hardly, if at all, traceable.⁸⁵

During the 1870s Galton formulated two physiological models of heredity. He stipulated that the hereditary units an individual receives from its parents are, at the moment of conception, subdivided into patent elements, destined to form the bodily parts, and latent elements that remain within the reproductive organs and are

passed onto offspring. Diverging from Charles Darwin's "provisional hypothesis of Pangenesis", Galton argued that patent cells have only a "weak effect" upon the nature of progeny.⁸⁶ As August Weismann pointed out, Galton never *absolutely* denied the possibility of the inheritance of acquired characteristics, nor did he insist on a close resemblance between the hereditary units forming the body and those residing in the testes and ovaries.⁸⁷ However, in both "Hereditary talent" and *Hereditary genius* he deemed soft heredity to be of negligible importance and excluded its putative effects from his calculations. In so doing, Galton deviated from the strong emphasis placed upon use-inheritance by many Victorian social reformers, ethnologists, alienists and doctors, as well as the vast majority of his contemporary phrenologists.

Indeed, several reviewers of *Hereditary genius* claimed that this important omission rendered his statistical demonstrations artificial and unconvincing. Endorsing Charles Elam's 1869 account of how "powers acquired by industry in one generation become hereditary in the next", the *Edinburgh review* insisted that soft heredity "is one great cause which evidently militates against the compilation of any such lists of more than a very general and superficial value".⁸⁸ Over a century later, R. S. Cowan considered Galton's rejection of use-inheritance equally striking. Yet, she perceived in hard hereditarianism a desire to promote social melioration whilst affirming existing social hierarchies. Michael Bulmer, in contrast, has recently argued that Galton's veering towards hard hereditarianism was predicated upon a rational consideration of the available evidence.⁸⁹ However, neither explanation is adequate: Cowan's because it underestimates the popularity of hard hereditarianism among mid-Victorian anthropologists, physicians and scientific naturalists; Bulmer's because the objections Galton raised did not do justice to the empirical and theoretical cogency of the case for the inheritance of acquired characteristics both before and after Darwin.⁹⁰ More importantly, neither author recognizes that the practical and evidential difficulties confronting Galton in 1864 absolutely dictated that he expunge his analysis of any trace of soft heredity.

Had Galton accepted that talents acquired by parents are hereditarily transmitted to their offspring this would simply have eliminated any possibility of separating nature from nurture. Use-inheritance demands, *a priori*, that the researcher ascribe causal significance to education and training in the dynamic process of individual mental ontogeny. It was therefore methodologically unacceptable for Galton on the grounds outlined in the previous sections: accepting the value of education and opportunity precludes isolating the role of heredity from environmental causes. Moreover, if soft hereditarianism is accepted, it becomes impossible to distinguish between innate qualities and endogenous influences for the fundamental reason that they are inextricably blended in the substance of the germplasm. At a physical level the very distinction dissolves. In sum, if educated parents transmit the seeds of their ability to their offspring, the continuity of intelligence in lineages is no longer empirically striking — rather it is what one would expect from a theory of use-inheritance. It is also, however, a phenomenon closed

to investigation.

Consequently, were Galton to have endorsed even the circumscribed soft hereditarianism of Charles Darwin, his project would have been a non-starter. He obviated the problem in the only way possible: by rejecting any notion of the inheritance of acquired characteristics. In its place he conceived of a hereditary material almost entirely immune to environmentally-induced, directional change. Variation, he implied, was usually produced by a variant of the mysterious and spontaneous modifications described by Charles Darwin, though of a more saltational nature. Thereby Galton managed to dispose of a serious theoretical obstacle, and he felt sufficiently confident in doing so that soft heredity was accorded not a single mention in *Hereditary genius*.⁹¹

conclusion

Francis Galton based much of his statistical analysis of mental heredity upon two syllogisms. First, that the lowborn genius will always achieve recognition. Second, that because the lowborn genius requires neither education nor familial connections to ensure his success, the well-born genius cannot be seen to have benefited from the privileged social environment into which *he* is born. On these spurious bases, by the end of the third chapter of *Hereditary genius*, as he had tried to do even less convincingly in 1865, Galton had delineated a category of evidence that could be considered in isolation from the effects of nurture. Adopting this implausible degree of biological determinism was in large part a means of evading theoretical and methodological problems that were otherwise insuperable given the state of mid-nineteenth-century statistical science. As a concession to what sociologists have dubbed “doability”,⁹² it is no exaggeration to say that Galton’s denial of the formative effects of circumstances and use-inheritance was simply *de rigueur*. Only in 1874, having received the plaudits of Darwin and Wallace, was Francis Galton content to lower his guard and candidly admit that which, in *Hereditary genius*, he had buried beneath a series of convenient rationalizations:⁹³

The effects of education and circumstances are so interwoven with those of natural character in determining a man’s position among his contemporaries, that I find it impossible to break them wholly apart. Still less is it possible completely to separate the evidences relating to that portion of a man’s nature which is due to heredity, from all the rest.⁹⁴

Nonetheless, in his 1874 *English men of science* Galton persisted in assuming that an early fascination for science connoted an inherited predilection, and that heredity was responsible *whenever* a man of science shared his vocation with other family members. He paid lip service to the importance of environmental influences, and implied that his earlier axioms had been less than cogent, but he conceded hardly any real territory at all.

However, Galton’s remarks on the causal complexity of intelligence are interesting because they flag up an important historiographical issue. The sorts of difficulties

Galton faced in assigning relative importance to heredity and environment are analogous to the challenges the historian confronts in trying to delineate the relative importance of the various factors — social, political, psychological, intellectual — that went into forming Galton’s hereditarian position itself. The basic problem is that because, like Galton, we are dealing with complementary strands of causation, one simply cannot identify unambiguous criteria by which to weight differentially the varied causal factors. Galton’s ‘genetic’ determinism, for instance, is symptomatic of élitist politics, a psychological drive to believe in the heritability of intellect, the intellectual context in which he was operating during the early 1860s, as well as the circumstances examined in this article. All are inextricably bound up together.

Accordingly, whilst I believe that the explicit way in which Galton struggled to evince the concept of mental heredity *does* show that empirical factors were of substantive importance in shaping his biological perceptions, I can identify no basis on which to say that this factor was more or less important than the rival causal themes that have been identified by other historians. Perhaps, ultimately, in these circumstances we just have to settle for the assurance that adding new explanatory insights brings us an indeterminate degree closer to an understanding of the complex mental arena from which ideas arise.

Nevertheless, I think there are grounds in this case for going a little further. Galton was too unconcerned about political matters to insist on a one-to-one correspondence between his scientific ideas and his undoubtedly élitist sociopolitical worldview.⁹⁵ And he was not so psychologically driven to think of intelligence as heritable to opt for the exceptionally hard-to-defend position that he unveiled in “Hereditary talent and character” and *Hereditary genius*. Thus, although political, psychological and various other factors may have fuelled — even motivated — Galton’s articulation of the hereditarian position, the demanding nature of producing a statistical analysis is the only factor that can account for the unprecedentedly extreme form that his hereditarianism eventually took. Historically speaking, the empirical constraints he encountered after 1864 are therefore of huge significance.

T. H. Huxley scorned the use of statistics in the life sciences, remarking, “as the grandest mill in the world will not extract wheat-flour from pea-cod, so pages of formulae will not get a definite result out of loose data.”⁹⁶ In the light of what has been said in this essay, Huxley was both right and wrong. Few would now deny that *Hereditary genius* falls a very long way short of providing a demonstration of mental heredity, largely because there is no overcoming the ambiguity of Galton’s pedigree data. But by redefining wheat-flour until it began to *look like* pea-cod, Galton did manage to persuade an influential section of the scientific community that he really had furnished a proof of mental heredity. Indeed, considering the intellectual gymnastics Galton performed in writing “Hereditary talent and character” and *Hereditary genius* it is perhaps time that we began to remember these works at least as much for their author’s technical creativity as for the degree to which they represent the purblind articulation of an élitist hereditarian position.

Finally, it is important to recognize the broader epistemological moral contained within this study: that the application of statistical methods to issues that do not readily admit of numerical analysis can force the acceptance of premises at variance with, or more extreme than, the researcher's own preconceptions. Thus, Galton was by inclination a hereditarian and a determinist. But he was a *hard* hereditarian and an *extreme* determinist largely by methodological necessity. In view of this, there seems to be every reason for looking again at a wide range of economists, sociologists and psychometricians to see if they too were led away from their private convictions as a consequence of a reliance upon numerical methods. Certainly, it seems rather unlikely that Galton is the only human scientist whose methodology dictated an acceptance of crude social and biological conceptions.

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7. Sreter, *Fertility, class and gender* (ref. 2), 57.
8. Mackenzie, *Statistics in Britain* (ref. 3), 509.
9. Raymond Fancher, “Biographical origins of Francis Galton’s psychology”, *Isis*, lxxiv (1983), 227–33. See also Raymond Fancher, “Francis Galton’s African ethnography and its role in the development of his psychology”, *The British journal of the history of science*, xvi (1986), 67–79, and Kevles, *Name of eugenics* (ref. 2), 10.
10. Victor Hiltz, “Obeying the laws of hereditary descent: Phrenological views on inheritance and eugenics”, *Journal of the history of the behavioural sciences*, xviii (1982), 62–77; Greta Jones, *Social Darwinism and English thought: The interaction between biological and social theory* (Hassocks, Sussex, 1980); Carlos López-Beltrán, “Human heredity 1750–1870: The construction of a domain”, unpublished Ph.D. thesis, King’s College London, 1992; John C. Waller “Ideas of heredity, reproduction and eugenics in Britain, 1800–1875”, *Studies in history and philosophy of biological and biomedical sciences*, in press; and John C. Waller, “The social and intellectual origins of Sir Francis Galton’s ideas on heredity and eugenics”, unpublished Ph.D. thesis, University College London, 2001.
11. One thinks immediately of later psychometricians, such as Cyril Burt and Hans Eysenck, whose hereditarian theorizing may also have been under-determined by the private social and political predilections given such prominence by historians (e.g. Stephen Jay Gould, *The mismeasure of man* (London, 1992)).
12. R. E. Kohler, *Lords of the fly: Drosophila genetics and the experimental life* (Chicago, 1994), espec. chap. 2.
13. Joan H. Fujimura, “Constructing ‘do-able’ problems in cancer research: Articulating alignment”, *Social studies of science*, xvii (1987), 257–93, and Gregg Mitman and Anne Fausto-Sterling, “Whatever happened to *Planaria*? C. M. Child and the physiology of inheritance”, in A. E. Clarke and Joan H. Fujimura (eds), *The right tools for the job: At work in twentieth-century life sciences* (Princeton, 1992), 172–97.
14. Galton archives (UCL), Folder 152/7.
15. See W. Robertson, *The history of America* (London, 1834); George Combe, *The constitution of man considered in relation to external objects* (Edinburgh, 1841), and E. Esquirol, *Aliénation mentale: Des illusions chez les aliénés. Question médico-légale sur l’isolement des aliénés* (Paris, 1832).
16. Fancher, “Biographical origins” (ref. 9), and Waller “The social and intellectual origins” (ref. 10).
17. In a forthcoming article I will show in more detail how Galton’s professional aspirations guided his decision to study the inheritance of intellectual ability. A preliminary account of this thesis is contained in Waller, “The social and intellectual origins” (ref. 10), chaps. 3 and 5.
18. Forrest, “Victorian genius” (ref. 1), especially chap. 6.
19. See Francis Galton, *Meteorographica, or Methods of mapping the weather* (London and Cambridge, 1863), 1.
20. See Francis Galton, “First steps towards the domestication of animals”, *British Association report*, 1864, 93–94.
21. See letter and notes, Emma Darwin to Joseph D. Hooker, 7 December 1863, in F. Burkhardt and S. Smith (eds), *The correspondence of Charles Darwin* (Cambridge, 2000), 445.
22. Alfred Russel Wallace, [review of *Hereditary genius*], *Nature*, i (1869–70), 501–3, and Charles

- Darwin to Francis Galton, 23 December 1869, Galton archives (UCL), folder 39E.
23. See Waller, "The social and intellectual origins" (ref. 10).
 24. Francis Galton, *Hereditary genius* (London, 1914 reprint), p. vi.
 25. See Francis Galton, *Memories of my life* (London, 1908), 45.
 26. For Galton's experience at Cambridge see Andrew Warwick, "Exercising the student body: Mathematics and athleticism in Victorian Cambridge", in Christopher Lawrence and Steven Shapin (eds.), *Science incarnate: Historical embodiments of natural knowledge* (Chicago, 1998), 288–325.
 27. See Francis Galton, *The narrative of an explorer in tropical South Africa* (London, 1853), 102. Galton's devotion to numerals and his demonstrable difficulties in social situations are broadly compatible with a diagnosis of mild autism, or Asperger's syndrome.
 28. For the history of modern statistics and the statistical approach to collecting and defining 'facts' see Mary Poovey, *A history of the modern fact: Problems of knowledge in the sciences of wealth and society* (Chicago, 1998); Theodore M. Porter, *Trust in numbers: The pursuit of objectivity in science and public life* (Princeton, 1996); Ian Hacking, *The taming of chance* (Cambridge, 1990); Theodore M. Porter, *The rise of statistical thinking, 1820–1900* (Princeton, 1986); and Victor Hiltz, "Statist and statistician: Three studies in the history of nineteenth-century English statistical thought", unpublished Ph.D. thesis, Harvard University, 1967.
 29. Porter, *The rise of statistical thinking* (ref. 28), 273.
 30. Anon., "Mr. Galton on nuts and men", *Spectator*, 16 May 1874, 623–4, p. 624.
 31. See Galton, *Narrative of an explorer* (ref. 27), 45, where he refers explicitly to Camper's methods.
 32. See, for example, John Carson, "Minding matter/mattering mind: Knowledge and the subject in nineteenth-century psychology", *Studies in the history and philosophy of biology and the biomedical sciences*, xxx (1999), 345–76. For a general account of the rise of physical anthropology see George Stocking, *Victorian anthropology* (London, 1987).
 33. See, for example, Paul Broca, *Hybridity in the Genus Homo*, transl. by C. Carter Blake (London, 1864); R. Knox, *The races of men: A philosophical enquiry into the influence of race over the destinies of nations* (London, 1862).
 34. See Galton archives (UCL), folder 152/7.
 35. George H. Lewes, *The physiology of common life*, ii (Edinburgh, 1860).
 36. *Ibid.*, 336.
 37. George H. Lewes, "Hereditary influence, animal and human" (reprinted from *Westminster review*), *Journal of psychological medicine*, 1 April 1857, 384–402, p. 384.
 38. Henry T. Buckle, *History of civilization in England* (London, 1857–61), i, 177.
 39. Lewes, *The physiology of common life* (ref. 35), ii, 315.
 40. Charles Darwin, *The origin of species by means of natural selection* (Oxford, 1996 reprint), 12–13.
 41. Francis Galton, "Hereditary talent and character", *Macmillan's magazine*, xii (1865), 157–66, p. 159.
 42. *Ibid.*, 165.
 43. Porter, *The rise of statistical thinking* (ref. 28), 142.
 44. Anon., "Hereditary genius", *The Scotsman*, 28 December 1869, 7.
 45. H. Merivale, "Galton on hereditary genius", *Edinburgh review*, cxxxii (1870), 52–64, p. 64, and E. Gökyigit, "The reception of Francis Galton's *Hereditary genius* in the Victorian periodical press", *Journal of the history of biology*, xxvii (1993), 215–40.
 46. John Stuart Mill, "Reply to Mr. Carlyle", *Fraser's magazine*, xli (1850), 25–31, p. 29.

47. See B. Knights, *The idea of the clerisy in the nineteenth century* (Cambridge, 1978) and Shearer West (ed.), *The Victorians and race* (Brookfield, 1996).
48. Anon., “Hereditary genius”, *The Times*, 7 January 1870, 10.
49. Anon., *op. cit.* (ref. 44), 7.
50. Anon., *op. cit.* (ref. 44), 9.
51. Of course, IQ studies are still dogged by debates as to how accurately they measure inborn ability *versus* the effects of neonatal and postnatal environments. See Gould, *Mismeasure of man* (ref. 11).
52. Galton archives (UCL), red notebook in folder 120/1.
53. Galton, *Hereditary genius* (ref. 24), 88 and 23.
54. See Gökyigit, “Reception of Francis Galton’s *Hereditary genius*” (ref. 45).
55. Anon., [Review of *Hereditary genius*], *Daily news*, 16 December 1869, 7.
56. See ref. 4.
57. Galton archives (UCL), red notebook in folder 120/1, and Francis Galton, “The history of twins”, *Journal of the Anthropological Institute*, v (1875), 391–406, p. 391.
58. Galton archives (UCL), black notebook in folder 152/7, and Galton, *Hereditary genius* (ref. 24), p. v.
59. Galton archives (UCL), 152/7. This is a strategy with many echoes in the ethnological discussions to which Galton had been privy since the early 1860s (see Waller, “The social and intellectual origins” (ref. 10)).
60. Galton archives (UCL), 152/7.
61. Francis Galton, “Hereditary talent and character”, *Macmillan’s magazine*, xii (1865), 318–27, p. 325.
62. Galton archives (UCL), in folder 134/1.
63. Galton archives (UCL), red notebook in folder 120/1, 44.
64. Galton, “Hereditary talent and character”, 320.
65. Galton, “Hereditary talent and character”, 321.
66. Galton, “Hereditary talent and character”, 322.
67. Charles Darwin, *The variation of animals and plants under domestication*, i (Baltimore, 1998 reprint), 451; Charles Darwin, *The descent of man and selection in relation to sex* (London, 1871).
68. Galton, *Hereditary genius* (ref. 24), 1.
69. Galton archives (UCL), red notebook in folder 120/1.
70. In addition, Galton claimed, schooling might also impart knowledge of the “*art of learning and of reasoning*”, Galton archives (UCL), 120/1.
71. Anon., *The morning post*, 16 April 1870, 5–6.
72. Francis Galton, “Hereditary genius: The judges of England between 1660 and 1865”, *Macmillan’s magazine*, xvi (1865), 424–31.
73. Galton, *Hereditary genius* (ref. 24), 2.
74. Charles Lyell, *The geological evidences of the antiquity of man, with remarks on theories of the origin of species by variation* (London, 1863), 504.
75. Anon., *op. cit.* (ref. 44), 6.
76. Galton archives (UCL), red notebook in folder 120/1.
77. Galton, “Hereditary talent and character” (ref. 41), 160.
78. Galton, *Hereditary genius* (ref. 24), 35
79. Galton, *Hereditary genius* (ref. 24), 78.

80. Galton archives (UCL), red notebook in folder 120/1, 46.
81. Galton, *Hereditary genius* (ref. 24), 12.
82. Francis Galton, *English men of science: Their nature and nurture* (London, 1874), 23.
83. Merivale, "Galton on hereditary genius" (ref. 45), 59.
84. George J. Romanes, *An examination of Weismannism* (London, 1893), 59.
85. Galton, "Hereditary talent and character" (ref. 41), 322.
86. Francis Galton, "On blood-relationship", *Proceedings of the Royal Society*, cxxxvi (1872), 394–402; Francis Galton, "A theory of heredity", *Contemporary review*, xxvii (1875), 80–95; and Michael Bulmer, "The development of Francis Galton's ideas on the mechanism of heredity", *Journal of the history of biology*, xxxii (1999), 264–92.
87. August Weismann, *The germ-plasm: A theory of heredity*, transl. by W. Newton Parker and Harriet Ronnfeldt (London, 1893), 9.
88. Merivale, "Galton on hereditary genius" (ref. 45), 6.
89. Bulmer, "The development of Francis Galton's ideas" (ref. 86), 266.
90. See, for example, M. J. S. Hodge, "Generation and the origin of species (1837–1937): A historiographic suggestion", *The British journal of the history of science*, xxii (1989), 257–65; López-Beltrán, "Human heredity" (ref. 10); and Charles Rosenberg, "The bitter fruit: Heredity, disease, and social thought in nineteenth-century America", in D. Fleming and B. Bailyn (ed.) *Perspectives in American history*, iii (Cambridge, Mass., 1974), 189–235.
91. Galton's assumption of germ-line superabundance and his insistence upon particulate inheritance also inhered in his attempts to render the data for hereditary transmission compatible with a statistical explication (see Waller, "The social and intellectual origins" (ref. 10)).
92. See ref. 13.
93. *Hereditary genius* had also been heavily criticized by Alphonse de Candolle. His critique of Galton's hereditarianism formed the basis of his *Histoire des sciences et des savants depuis deux siècles: suivie d'autres études sur des sujets scientifiques en particulier sur la sélection dans l'espèce humaine* (Geneva, 1872). Galton clearly felt the need to make some concessions to de Candolle's largely unfavourable evaluation.
94. Galton, *English men of science* (ref. 82), 24.
95. See Waller, "The social and intellectual origins" (ref. 10), espec. chap. 2.
96. Quoted in R. A. Boakes, *From Darwin to behaviourism: Psychology and the minds of animals* (Cambridge, 1984), 47.