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5 "Not Guilty, by Reason of Genetic Determinism"

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Introduction

The possibility that genetic research might identify 'genes for criminal tendencies' has stimulated intense controversy. Media interest in the case of Stephen Thomas Mobley in which a 'genetic defence' was pursued, together with news coverage of a conference in London in 1995 on 'The Genetics of Criminal and Antisocial Behaviour', brought the question of a link between genetics and criminal behaviour to wide public attention. Since then a steady output of newspaper articles and television documentaries have reflected continuing interest and concern over the suggestion that criminals might be born, not made. The nature/ nurture debate rages on in many channels, but amongst psychologists and geneticists it is largely resolved, *both are important*.

In this paper I examine two possible theses of *Genetic Determinism*.

Weak Genetic Determinism. Genetics has a role in the causation of a range of behavioural and/or personality traits relevant to criminality.

Strong Genetic Determinism. Genetics is a causally sufficient condition (under normal circumstances) for a range of behavioural and/or personality traits that lead to criminality.

I will start with an overview of the current state of Behavioural Genetics in order to explain the two theses. Then, I will argue that Behavioural Genetics warrants a firm rejection of Strong Genetic Determinism, at least for the majority of behaviours relevant to criminality. However, we should not move too swiftly from this to rejecting the independent thesis of Weak Genetic Determinism which, I will argue, is in essence justified. There are many important implications of Behavioural Genetics which are relevant to our thinking about criminality. To illustrate this, I propose

to comment on an aspect of just one; the possibility of a defence of, "Not guilty, by reason of Genetic Determinism".

Explanations of Genetic Determinism

We must understand Genetic Determinism in the context of the empirical findings of Behavioural Genetics. Our first task, then, is to understand those findings. It will not be possible here to defend Behavioural Genetics in any detail, but I hope to show that its findings should be taken seriously. Even if, in the end, one still wishes to dispute the claims of Behavioural Genetics, it is as well if one's objections are directed at the right claims; that is to say, *not those of the press*. I think that much of the resistance to Behavioural Genetics would dissipate if it were appreciated just how limited its claims really are.

Our starting point is observed phenotypes of the personality/ behavioural traits of individuals. (I should just say that I will tend to use 'behaviour' and 'personality' fairly interchangeably although they are, of course, distinct.) We can get a good idea of what is going on by considering two basic things that Behavioural Genetics studies and two basic questions that are asked about each. This may be summarized quite easily as follows;

The extent to which differences between individuals, for a given behavioural trait are explained by:

(a) variation in genetic makeup.

(b) variation in the individual's environment.

The extent to which similarity between individuals, for a given behavioural trait is explained by:

(a) similarity in genetic makeup.

(b) similarity in environment.

A basic prerequisite is that there must be some *measure* of personality/ behaviour. If there were no such measure, however imperfect, there could be no sense given to the idea that different individuals can have a behavioural trait to differing degrees. However, it clearly does make sense to talk of one person being more aggressive than another, or of someone being just as impulsive as her brother. These comparisons of how aggressive or impulsive people are rely on the idea of a quantitative aspect to these traits.

Typically, psychological testing involves the subject in answering a series of questions with simple yes/no answers or a multiple choice selection. Different scores are awarded for each possible answer and the overall score is assumed to give some numerical measure of the trait being tested for, whether it be IQ, neuroticism, aggression or whatever. Such tests

are highly controversial regarding what they actually do measure but it would be a mistake to see this as a serious problem for our whole project. First, note that what the tests measure directly is *behaviour*; the behavioural response of ticking box 'c' for question '8', for example. Conclusions regarding *personality* are inferences from these *behavioural* responses. Nevertheless, I believe it would be a brave person who claimed that there was *no* correlation between psychological test results and personality. We must accept that personality tests are far from perfect, but to think that they bear absolutely no relation to personality is an unreasonable intransigence to which few people would adhere. Anyone who is convinced that psychological tests don't really measure anything, should not feel any particular concern at finding themselves on the last train from Waterloo, alone but for one person who they happen to know ticked box (c), 'Very often', to question (8), 'How often do you feel sudden, violent, uncontrollable rage?'.

My fundamental point is this; even accepting the limitations and uncertainties of personality testing, a correlation between the personality scores of different individuals is still a correlation. If there turns out to be a correlation with genetic inheritance, that the influence of our genes has had to show itself through the uncertainty of our testing methods is, if anything, more suggestive of the significance of genetics.

Once we have some measure of a behavioural trait, there are three important statistical devices to consider. The first is *variance*, a measure of how far individual scores vary around the mean score in the population. A high *variance* indicates that many individuals in a population have scores that differ substantially from the mean score. A low variance indicates that individual scores tend to be quite close to the mean score for that population. The second statistical tool is *correlation* between the trait scores of different pairs of individuals. If pairs of twins are compared and the trait scores in each pair are very similar to each other (much more similar than one would expect if comparing randomly selected pairs of individuals) then the twins show a strong correlation for the trait in question. The idea is that if the trait scores of genetically related individuals are correlated more closely than those of unrelated individuals, then this suggests genetic influence. *If environmental bias can be eliminated*, the genetic correlation between pairs of individuals in a population (from family trees) can be compared with their correlation for a trait (from behavioural tests) to give the third important measure, *heritability*. Heritability is often misunderstood and wrongly taken to mean much more than it really does. It is an estimate of the proportion of variance for a trait, that is associated with genetic variance. For example,

a heritability of 0.4 for a trait means that 40% of the variance for the trait is attributable to genetic variance in that population. In other words, if all the genetic variance in the population was removed, 60% of the trait variance would still remain, the 60% that was attributable to environmental variance. This is represented in the figure below (not to scale);

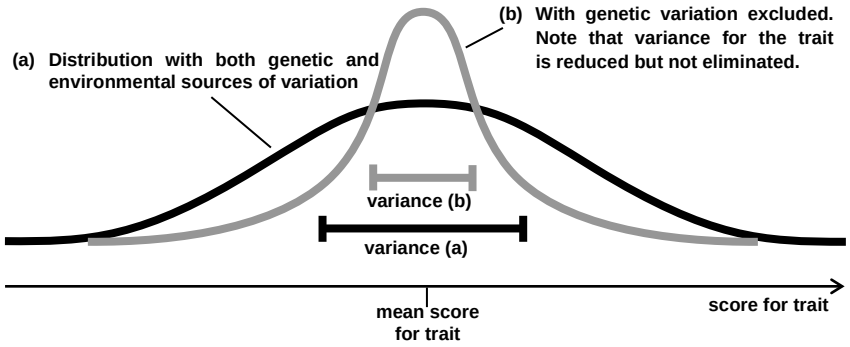

Fig 5.1 Distributions of trait scores in a population.
The graph is higher where it corresponds to scores that are more common in the population. Without genetic sources of variation, (b), people's scores are grouped more tightly round the mean score.

Note that heritability only has meaning relative to a population and not directly for particular individuals. A single individual cannot have a *heritability*, because an individual cannot have a *variance* from her own score! Also, in a population with *no* variance for a trait, for example if everyone has blue eyes, the heritability for that trait in that population will be undefined because there is no variation to inherit. This does *not* mean that blue eyes are not genetically determined.

I mentioned the assumption that environmental bias can be eliminated, but is this so? Related individuals often have similar environments as well as similar genes. They tend to be brought up in the same family and under similar social and economic circumstances. If related individuals do tend to be similar in behaviour, this might be because of the similarities in their environments. How can Behavioural Genetics separate the genetic and environmental factors? Different studies have addressed this problem from different directions and there is broad agreement that bias due to similar environment does not pose a serious problem. It would seem that environmental similarity has little influence on behavioural similarity (Bouchard, 1994; Plomin et al., 1994). The best studies, from this point of view, are those that compare populations

of identical and non-identical twins that have been separately adopted (e.g. Bouchard & McGue, 1990; Loehlin et al., 1990). This addresses the worry that bias might result if identical twins are treated more similarly within a family than their non-identical counterparts. For more details on the methods and measures of Behavioural Genetics see Plomin et al., (1980).

Let's move now to some answers to the basic questions of explaining variation and similarity between individuals. A number of personality traits and sub-traits have been studied. Of particular interest for criminality, are studies of aggressive behaviour, though others such as impulsiveness, sociability and dominance, are likely also to be relevant. Fortunately, there is broad agreement between independent studies and the results for most of the different traits so far studied are remarkably similar (Bouchard, 1994; Carey & DiLalla, 1994). This means that we do not need a detailed review of each study of each behavioural characteristic in turn, instead we can generalize without going too far wrong. There are, of course, exceptions, of these I will say more below.

So, what is the answer to the nature/nurture debate? As I said at the beginning of the introduction, both are important. More specifically, for the majority of personality/behavioural traits studied to date, it seems that about 40 to 50% of the variance can typically be attributed to genetic factors (nature). Environment is responsible for *over half* of the variance in the trait. Note that 'environment' includes not only the circumstances of a person's upbringing, this is just its most obvious and important aspect, 'environment' also includes everything that is not inheritable, all the non-genetic factors that might be relevant, from experimental error to free will.

What of the explanation of behavioural *similarities* of related individuals? Here it seems that genetics has most of the influence, similarity of environment typically accounting for less than 10% of behavioural correlation between individuals for most traits that have been studied. More details of various relevant studies can be found in Plomin et al., (1980) and in recent review articles Bouchard, (1994); Carey & DiLalla, (1994); Nigg & Hill Goldsmith, (1994); Plomin et al., (1994).

It seems odd that genetics should have a minority influence in accounting for differences, while being so overwhelmingly responsible for similarities between related people. Can this be right? An analogy will help. Consider the trait of fuel consumption in cars (a factor clearly related to criminal running costs!). How much of the variance in miles per gallon in a population of cars is to be explained by design (genetics)

and how much by environment? We would expect difference of design to explain much of the difference in fuel economy between a Nissan Micra and an Aston Martin. We would also expect *environment* to be significant. A car used for towing sheep to market in the Scottish highlands would be expected to show much higher fuel consumption than one driven by a sedate middle-aged driver with a twice daily commuter run along flat dual-carriageway. Would there be a correlation between the fuel consumption of different Nissan Micras (related by design)? Indeed one certainly would expect a significant correlation in the fuel efficiency of cars of the same model. This would largely be explained by similarity of design. No amount of similar environment will make an Aston Martin return 40mpg.

Some exceptions

There are three classes of exception to the general findings described above that I wish to mention. First, those in which a *similarity* of behavioural trait is explained predominantly by *similar* environment. Second, those in which *similarity* is explained by *different* environment. Third, in more detail, those in which a trait seems overwhelmingly under genetic control.

A simple example will clear up any mystery surrounding the possibility of the first kind of exception. There will be a close similarity in the behaviour of two individuals, whether genetically identical or unrelated if both share the common environmental factor of having had a frontal lobotomy. (This is why even Strong Genetic Determinism needs an 'under normal circumstances' clause.) Shared environmental factors of this ilk lie outside the ambit of studies in Behavioural Genetics. They emphasise the importance of bearing in mind the distinction between populations and individuals before applying the findings of Behavioural Genetics, especially in unusual circumstances.

The second class of exception may be understood by returning to the car example. It will be possible to get a Nissan Micra to return fuel consumption figures as high as those of an Aston Martin by manipulating the environment of each car. If the Aston in the charge of the middle aged commuter and the Micra on sheep hauling duty for our Scottish farmer, the generally more fuel efficient Micra could well return fuel economy figures comparable to those of the Aston. In individual cases the influence of genetics (or design) might be swamped by opposing environmental influences.

The third class of exception I mentioned, those in which genetics seems overwhelmingly important, is more interesting. A possible

example of this kind of exception is Tourette's syndrome. This is a treatable condition with a genetic basis which can lead to extremely uninhibited and uncontrollable behaviour, including swearing and sexual behaviour. (Perhaps Diogenes, the philosopher famous for telling Alexander the Great to get out of his light and for masturbating in public, was a sufferer! This is clearly the kind of behaviour that might attract the attention of the criminal authorities!) To get to grips with this third class of exception I need to say something about the role of Molecular Genetics in Behavioural Genetics.

Molecular Genetics adds support to the general claims made so far and fills an important gap in what the population studies can tell us about the genetic basis of behaviour. All we have from Population Genetics are correlations between behavioural traits and inheritance. What is missing is an account the mechanism behind the correlations. Molecular Genetics studies how the proteins encoded by our genes interact with the individual's neurophysiological development and functioning to influence behaviour. There is a *causally explanatory* link from genes to aspects of behaviour. This blocks the move of dismissing the findings of population studies in Behavioural Genetics as '*mere correlations*' between a genetic marker and a behavioural trait. The techniques of Molecular Genetics also offer help in understanding the genetic basis of behaviour in particular individuals and in atypical cases. One such unusual case concerns aggressive behaviour identified in some members of a family in Holland. This is an example well worth mentioning.

The Dutch Family

In 1978 a Dutch woman sought genetic counselling. There was a marked tendency to impulsive aggressive behaviour in some males in the family, leading to crimes including assault, arson and attempted rape. In 1978 there was no possibility of studying the underlying Molecular Genetics, but the apparent pattern of inheritance of the behaviour was consistent with a sex linked genetic trait (affecting males but carried and passed on to their children by females). Recently Molecular Genetics techniques have identified a possible culprit gene (Brunner et al., 1993). There is a point mutation in a gene normally involved in producing an enzyme called Monoamine Oxidase A. This enzyme is involved in the regulation of aspects of brain biochemistry which have been associated with aggressive behaviour in human and animal studies. (Most people are aware of the potential side effects of anabolic steroid use. This illustrates the fact that biochemistry can influence behaviour.) Much more study is

needed to isolate the significant neurophysiological effects and mechanisms, and to confirm the link in other families. The case against the suspect gene is far from closed, but I hope this gives enough of a feel for what Behavioural Genetics can reveal, for us to go on to consider the two theses of Genetic Determinism.

Strong Genetic Determinism

Strong Genetic Determinism is the thesis that, 'genetics is a causally sufficient condition (under normal circumstances) for a range of behavioural and/or personality traits which lead to criminality'. We can now see that it is clearly false, at least for the great majority of behavioural traits relevant to criminality that have been studied to date. Remember the finding that over half of the variance of typical behavioural traits is accounted for by *non*-genetic factors.

Even so, it might seem that the door is still open for a return of the thesis. Strong Genetic Determinism might be rejected on either epistemological or on ontological grounds. On an epistemological rejection, it might be argued that present lack of knowledge of the genetic cause of our behaviour does not imply there are no such genetic causes. Perhaps human behaviour really is fully genetically determined, it could simply be that over half of that full genetic explanation is not known. That Behavioural Genetics cannot now give the full explanation of human behaviour does not show that aspects of behaviour currently unexplained by genetics must be environmental in origin rather than genetic. Perhaps future advance in Behavioural Genetics will fill that gap and the apparently 'environmental' component will vanish.

This is not my claim. I reject Strong Genetic Determinism on stronger, ontological grounds. Population Genetics tells us about the genetic inheritance of behavioural traits in a way that depends only on knowing simple facts from family trees about how closely individuals are related to each other. It does not depend on knowing the mechanisms by which genes act. The reason that we can't know the genetic explanation of 100% of our behaviour is not the limitations of science, but that *the explanation of over half the variance is not genetic at all*. Even with genetic variance eliminated, Behavioural Genetics tells us that over half the variance in personality and behavioural traits would remain. On both the epistemological and ontological rejections of Strong Genetic Determinism, we can agree that we will never, in fact, manage to find a full genetic explanation of behaviour. I deny that there is any such full genetic explanation.

We are not trying to complete an explanatory jigsaw of human behaviour, unsure of how far we can get using genetic pieces. With a jigsaw, we can get an idea of how much of the full picture is sky and how much grass even before a single piece is in its rightful place. So it is with the explanation of variance in behaviour, we can get an idea that the total proportion of genetic pieces in the puzzle is a bit less that the proportion of environmental pieces, without yet knowing where all the pieces will eventually fit.

Weak Genetic Determinism

Weak Genetic Determinism made the more modest claim that genetics has a role in the causation of a range of behavioural and/or personality traits relevant to criminality. I believe that the findings of Behavioural Genetics give strong support to this thesis. We have seen that there is a correlation between genes and behaviour and how Molecular Genetics helps to uncover the causal mechanisms underlying that correlation. Weak Genetic Determinism is not just a heavily qualified, half-hearted version of the Strong Thesis. It involves a *positive* claim that non-genetic factors are relevant in explaining behaviour. However, it is claimed that genes do have significant *causal* influence over behaviour. Including traits, like aggression and dominance, that are related to criminal behaviours.

Whatever faith one places in the results of Behavioural Genetics to date, at least it is clear that Weak Genetic Determinism *could* be justified. But let's consider four groups of objection to the findings that support Weak Genetic Determinism. I will call them the Complexity Argument, Denial of Determinism, Appeal to Past Failure and Whatever it is it Ain't Determinism.

The *Complexity Argument* is simple and appealing. Given that the science of Behavioural Genetics is rather complex and forbidding, the suspicion that hidden in all the complexity is a serious mistake can be considerably more attractive than what might seem to be the alternative of being forced to some very unpalatable conclusions. Surely we cannot merely be the victims of our genes!? I give two responses to this. The first is simply to point out that the truth is under no obligation to be pretty. The alleged unpalatability of a conclusion is no argument against its truth. The second response is that, though Behavioural Genetics might seem complex, there are important general points that it is perfectly possible to grasp. Having done this and rejected Strong Genetic Determinism, we can see that Behavioural Genetics does not obviously warrant the unpalatable conclusions that are causing concern. Indeed

Behavioural Genetics, in showing the limits of the genetic explanation of behaviour, seems to support the conclusion that we are not just thralls to our genes.

The second set of objections, based on *Denial of Determinism*, urge that Genetic Determinism is mistaken because it has implications that we know to be false, principally the implication that our actions are determined. We know this is false, it is alleged, because we know we are agents who chose our actions for our own reasons. Our actions, including, if not especially, our criminal actions, are *not* fixed for us by sub-microscopic bits of genetic code.

This is unsound. Firstly, consider the broader free will/determinism debate between compatibilist and incompatibilist. The Denial of Determinism objection relies on an incompatibilist view of determinism whereby it is assumed that, if determinism is true, this must be incompatible with the kind of moral responsibility we take ourselves to have. But this view is disputed by compatibilists, who hold that we cannot infer from the truth of determinism, the conclusion that we are not free agents as we ordinarily take ourselves to be. This is a long running dispute which obviously cannot be resolved here, but compatibilist arguments certainly cast doubt on the validity of the Denial of Determinism objection by questioning its incompatibilist form. The second reason for holding this objection to be unsound is that the argument proceeds from the false premise of Genetic Determinism interpreted along the lines of the Strong Thesis. This, as we have seen, is mistaken. Interpreted on the Weak Thesis, the Denial of Determinism argument is transparently unsound. Even if determinism did preclude the possibility of our being agents who are truly able to choose our own actions, as we have seen, Genetic Determinism properly understood as Weak Genetic Determinism, does not have the implication that our actions are fixed for us. Behavioural Genetics shows that our behaviour is not simply determined by our genes.

Many sceptics regarding the findings of Behavioural Genetics use the *Appeal to Past Failure* (e.g. Rose et al., 1984). Certainly, well publicized 'discoveries' of links between genetics and behaviour which are subsequently thoroughly discredited, make new claims harder to accept. Such lessons rightly urge caution but the converse of the Stock Market adage is worth remembering, 'Past performance is no guarantee of future *failure'*! Spectacular mistakes are more than balanced by a vast and increasing body of research which supports the cautious findings I have outlined and has stood up to close examination. Indeed, uncovering the goofs is itself a success of Behavioural Genetics, not of any of the

criticisms of it. (See, for example the tale of the supposed 'alcoholism gene' in Holden, 1994.)

It is reasonable to worry that Weak Genetic Determinism is too weak to be determinism at all, *Whatever it is, it Ain't Determinism*. The difficulty is terminological rather than substantive but nonetheless helpful to consider. It is appropriate to talk of a thesis of gravitational determinism while recognizing that other forces act on bodies as well. To think of gravity in the context of determinism, we do not have to think of it as the only causally relevant factor. This tells in favour of the Weak Thesis being described as a thesis of determinism. Genetics is, after all, relevant in explaining behaviour, it's just not the only thing that is. It also highlights a significant feature of the Thesis, that it is a denial of Strong *Genetic* Determinism, not a denial of strong determinism *per se*. Genetics could be part of a broader fully deterministic account of behaviour just as gravity can be part of a broader fully deterministic world view. A fully deterministic view of human behaviour is neither ruled out nor forced upon us by the Weak Thesis. It does, however, tell us that genetics is not the whole story in accounting for criminal behaviour.

A cautionary interim summary

In this brief overview of Behavioural Genetics, much of the subtlety and complexity of the field has inevitably been lost. It is worth taking a just little time to take a cautionary look in the direction of a few of the missing bits. First, something that suggests how Behavioural Genetics might do rather better than even Behavioural Genetics itself had assumed. It has long been recognized that most human behaviour is not explicable in the terms of simple Mendelian inheritance. The genetic component in most human behaviour is *polygenic*; that is, many genes are involved in the genetic basis of behavioural traits that occur in varying degrees. IQ and aggression are obvious examples of traits that are a matter of degree, rather than all or nothing. It has generally been assumed that picking apart the genetic component in polygenic traits will remain forever beyond us because the contribution of any individual gene will be too small to be detectable. New statistical techniques of the Quantitative Trait Loci (QTL) approach overturn assumptions that polygenic traits are dead ends for research towards a more detailed understanding of the genetic basis of behaviour. A gene with even quite a modest contribution to the variance of a behavioural trait can be detected and studied using QTL.

An important warning is to be careful about applying the findings I have outlined to individual cases. For example, if the heritability for

aggression is 0.4, we should not immediately say of any particular individual that their aggression is 40% due to their genes and 60% due to environment. Even if this makes sense (and I have doubts), such simplistic application of population findings to individuals is wholly unwarranted. We should also be very wary of applying the findings in cases either at the extremes of criminal behaviour or in very unusual environments. This is not to say that applying the ideas of Behavioural Genetics in individual and atypical cases is always hopeless. In the example of the Dutch Family we have seen how Molecular Genetics and family studies can together provide insight in the individual case.

Fascinating results in Behavioural Genetics are emerging in the area of *Multivariate Analysis*. This looks at the interactions and correlations between different traits (Bouchard, 1994; Plomin et al., 1994). Interestingly, it seems that genetics, via personality, has significant influence on people's environment. We selectively attend to some aspects of our environment rather than others, we seek out certain kinds of environment and we actively modify the environment in which we find ourselves. This suggests that at least some of the similarity of environment of related individuals can be an effect rather than a cause of their similarities of personality (Bouchard, 1994; Lytton, 1990a, b).

Bearing these cautions in mind, we have found that there are good reasons to reject Strong Genetic Determinism and, at least to take seriously a thesis something like Weak Genetic Determinism. A central aim of this paper has been achieved if we understand just how modest the claims of Behavioural Genetics really are. This understanding makes a difference. To illustrate this I will now consider an aspect of legal guilt, how should we find if a defendant pleads "Not Guilty, by reason of Genetic Determinism"?

"Not Guilty, by Reason of Genetic Determinism"

The possibility that Behavioural Genetics might be used as the basis for some kind of 'genetic defence' in criminal cases was first brought to wide public attention by publicity surrounding the Stephen Thomas Mobley case in the U.S. Mobley was convicted in February 1994 of the murder of John Collins and sentenced to death. Inspired by the Dutch family I mentioned earlier, and patterns of aggression in the Mobley family tree, his lawyers attempted to put together a genetic defence, not in hope of an acquittal, but to try to have the sentence reduced from death to life imprisonment. The defence claims that there is a pattern of aggression and business success(!) in Mobley's ancestry which suggests a relevant genetic aetiology underlying his criminal behaviour.

In Mobley's case the genetic defence was rejected by the jury. Whatever the merits of that particular case, might the findings of Behavioural Genetics that we have considered provide any grounds for a legal defence? The first question to address is that of what is needed to prove legal guilt? There are two elements that must be present for criminal liability in the U.S. and the U.K. These are *actus reus* (the objective act itself) and *mens rea* (guilty mind). We can assume that *actus reus* is not in question, a genetic defence would question *mens rea* or provide some excuse which exculpates the defendant. One might expect such defences would be allied to Not Guilty By Reason of Insanity defences. Historically, in English and U.S. law, the standard for such defences has developed from interpretations of the ruling in the McNaghten case of 1843. The standard has become known as the McNaghten rules. Currently, in the U.S., it is interpretations of standards set out in the Model Penal Code that are usually referred to.

Under McNaghten, a defence is allowed if the defendant "was labouring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing; or, if he did know it, that he did not know he was doing what was wrong." (McNaghten's Case, 1843, Eng. Rep 8. 718,722. Quoted in Schopp, 1991 p.28)

If the 'disease of the mind' has a genetic origin, then genetic evidence might be relevant under McNaghten. But this is not a new kind of 'genetic defence', rather it is genetic evidence relevant in a standard insanity defence. The causal account is still in terms of "defect of reason", not defect of gene. There is no suggestion that Stephen Mobley was labouring under any "defect of reason" that would make him a candidate for such a defence. Another standard in English law relating to murder might be relevant, that of Diminished Responsibility (Section 2 of the Homicide Act 1957), which applies if a defendant's "abnormality of mind" is such that it "substantially impaired his mental responsibility for his acts and omissions..." (Jacobs, 1971 p.47). This is rather vague, particularly regarding the interpretation of 'mental responsibility'. A clearer framework for considering a possible genetic defence questioning responsibility for the act, is found in the Model Penal Code which states that a person "...is not responsible for criminal conduct if at the time of such conduct as a result of mental disease or defect he lacks substantial capacity either to appreciate the criminality of his conduct or to conform his conduct to the requirements of the law." (American Law Institute, Model Penal Code and Commentaries sec. 4.01, 1985. Quoted in Schopp, 1991 p.30)

Again, if the appeal is to the defendant's lack of ability to "appreciate the criminality of his conduct" because of delusional beliefs or impairment of reasoning, we have the possibility of genetic evidence as part of a standard insanity defence. Genetic facts might be brought in support of a standard insanity defence contention that the defendant suffered a "mental disease or defect". But focusing on the ability to "conform his conduct to the requirements of the law" there could be a specifically *genetic* defence. The defence might argue that, although the defendant carried out the act voluntarily, intentionally, without defect of reason and knowing it to be wrong, sh-he was unable to do otherwise, "unable to conform his conduct to the requirements of the law" because of Genetic Determinism. The causal account is in terms of the defendant's genetics, the need to demonstrate defective reasoning or other psychopathology is by-passed.

Having examined the claims of Behavioural Genetics we are now able to assess this line of defence. On the Strong Thesis of Genetic Determinism (that genetics is a causally sufficient condition for a range of behavioural and/or personality traits that lead to criminality), one could argue that because genetic facts about the defendant are causally sufficient for her criminal act, and those facts are certainly not under the defendant's control, it was not possible for the defendant to conform her conduct to the law as is required to justify criminal liability.

However, I have argued that we should *not* accept the Strong Thesis, but the Weak Thesis, that genetics has a role in the causation of a range of behavioural and/or personality traits relevant to criminality. Looking at Behavioural Genetics in more detail, we have found that environment, *not genes*, is likely to be responsible for over half of the variance in aspects of behaviour relevant to criminality. The Weak Thesis simply does not give reason to believe that people's genes generally make them unable to conform their conduct to the requirements of the law. The general findings of Behavioural Genetics, properly understood, do not justify such a genetic defence.

Ironically it is this *general* failure of Genetic Determinism, properly understood as the Weak Thesis, to provide grounds for a genetic defence that might make such a defence possible in exceptional cases. I have described a history of aggression in a Dutch family as being an exception to the general findings of Behavioural Genetics. The case is an exception because it suggests a much stronger genetic influence than is usual in behavioural traits. It is a matter of degree perhaps, but it does seem that the pattern of impulsive aggression in affected members of the family is much closer to being consistent with Strong Genetic Determinism, for

that particular trait in the *specific individuals affected*. If such an aetiology can be established (and I hope that the earlier discussion shows how it might be justified, possibly with the help of Molecular Genetics) a genetic defence could be based on the Model Penal Code standard that a particular defendant was unable to conform her conduct to the law. It could be argued, in unusual cases, that the criminal behaviour, with which the defendant is charged, was *strongly* genetically determined by some genetic abnormality in that particular defendant. Defendants in such cases, having no control over their genetic abnormality might be considered to be exculpated, in virtue of being unable to conform their conduct to the law.

The irony is that, under the Model Penal Code, if the Strong Thesis were *generally* true, having ruled *in* the possibility of a genetic defence, it would rule it straight *out* again. Recall the requirement that the inability to conform one's conduct be a "result of mental disease or defect". If the Strong Thesis were generally true, the inability to conform would just be an ordinary feature of people and could hardly be seen as a "disease or defect", as the standard requires for a defence to be successful. Something that bears upon this point is taken up by Schopp in his treatment of the voluntariness requirement for criminal liability. One thing that is required, says Schopp, is that the act be under control "in the sense that ordinary human action is under control" (Schopp, 1991 p.2). This suggests that if *ordinary* human action were under control in the sense of Strong Genetic Determinism, that a criminal act is under control in this sense cannot be a defence. In other words, the law is explicitly *compatibilist* regarding ordinary human action and *legal* responsibility. Even incompatibilists can accept the usefulness of *legal* responsibility in influencing ordinary human behaviour. We can remain agnostic regarding compatibilism and *moral* responsibility.

Because of the law's essential compatibilism about legal guilt, the general truth of Strong Genetic Determinism would rule out my proposed genetic defence. However, the Strong Thesis is false as a general account of human personality and behaviour. So, it could be possible in exceptional cases, where a trait in a particular person does seem to be sufficiently close to being Strongly Genetically Determined, for the defence to argue that this is an abnormality, a "disease or defect". In such a case the defendant's action could be said not to be under control "in the sense that ordinary human action is under control". Genetic Determinism would therefore not be ruled out, on this basis, as a defence in criminal cases.

One might worry about accepting such a genetic defence on the grounds that it would be available to anyone. If we accept any genetic defence the whole notion of criminal liability would seem to break down. Clearly the kind of genetic defence that I envisage would not be available to all defendants. In accepting the possibility of a genetic defence in this way, one does not commit oneself to denying criminal liability in the great majority of cases.

It would be reasonable to complain that this still isn't a new kind of defence, just genetic evidence relevant in deciding the question of the control defendants have over their actions. In a way this is clearly right. I have not argued that Behavioural Genetics shows the need to introduce a whole new category of defence into the criminal code. Even so, the distance between this and ordinary lines of defence questioning *mens rea* seems to me to justify seeing it as a genuinely new defence. The most striking difference is that, unlike more familiar *mens rea* defences, there is no essential appeal to the defendant's mental states or cognitive functioning, rather the appeal is to their behaviour and genetics. If, despite all this, someone wants to say that the genetic defence I outline isn't *really* a new defence, this really is no more than a terminological quibble and I will happily concede the point.

Summary

I must rest my case here. There is much more to be said about the precise conditions in which genetic defences should succeed, the degree of genetic determinism that is sufficiently close to Strong Determinism to count and how this might properly be established. One should also consider the ethical basis for such defences and whether present legal standards really are morally adequate to deal with possible genetic defences. Questions are raised even in cases where genetics is insufficient to justify a finding of 'Not guilty'. Might genetics nevertheless be relevant in sentencing, as was unsuccessfully argued in the Mobley case? There is also the issue of the appropriate treatment of defendants whose genetic defences are successful but who remain a threat to themselves or others. This parallels familiar questions regarding what is appropriate for defendants whose Not Guilty by Reason of Insanity defences have been successful. A 'Not guilty' finding in these cases is no guarantee that the defendant will go free. A successful Not Guilty by Reason of Insanity defence can mean that instead of a fixed term in prison the defendant receives an indefinite period of incarceration in an institution for the criminally insane.

I hope I have been able to show some ways to avoid misunderstanding the claims of Behavioural Genetics, and explain why we should reject Strong in favour of Weak Genetic Determinism. This conclusion does make a difference in our treatment of criminal liability and raises the possibility of genetic defences in a few cases. It seems that the general rejection of Strong Genetic Determinism and acceptance of the Weak Thesis might make a genetic defence arguable in exceptional cases, without undermining the general notion of criminal responsibility.

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