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Behavioural Genetics: Why Eugenic Selection is Preferable to Enhancement

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ABSTRACT *Criminal behaviour is but one behavioural tendency for which a genetic influence has been suggested. Whilst this research certainly raises difficult ethical questions and is subject to scientific criticism, one recent research project suggests that for some families, criminal tendency might be predicted by genetics. In this paper, supposing this research is valid, we consider whether intervening in the criminal tendency of future children is ethically justifiable. We argue that, if avoidance of harm is a paramount consideration, such an intervention is acceptable when genetic selection is employed instead of genetic enhancement. Moreover, other moral problems in avoiding having children with a tendency to criminal behaviour, such as the prospect of social discrimination, can also be overcome.*

I. Introduction

Recent discoveries in human behavioural genetics indicate putative associations between specific genetic markers and a range of complex traits, including criminal tendency.[1] Unlike many such projects dogged by retractions, one subset of criminal tendency research has produced compelling results: the correlation of mutations in the monoamine oxidase A gene and criminal behaviour within a Dutch criminal kindred. If this research proves valid, questions will inevitably arise about the moral acceptability of couples using reproductive technology to avoid having a child with criminal tendency.

In this paper, we employ this Dutch criminal kindred research to discuss the morality of selecting against criminality in future children. After briefly tracing the history and controversy of eugenics and behavioural genetics research, we summarise the theory that biochemical pathways involving monoamine oxidase can influence a person's chances of engaging in criminal behaviour at some point in their lives. We then utilise this example to argue (drawing on Parfit's non-identity problem) that choosing children without mutations in their monoamine oxidase A genes is acceptable, particularly if genetic selection technology is employed over genetic enhancement. This is because genetic selection is more immune than genetic enhancement to arguments depending on concepts of harm to the child.

However genetic selection remains subject to other objections not met by the use of this technique, which could affect its 'immunity' to arguments based on harm to the child. Therefore, we consider potential problems such as the child's right to an open future, privacy and parental expectations. We also consider arguments derived from social harms, such as diversity and discrimination.

We conclude that if used in a controlled and appropriate way with due concern for possible outcomes, genetic selection to avoid criminal tendency is morally justifiable.

II. Behavioural Genetics and Eugenics

Research into genetics and criminality is, of course, haunted by the spectre of eugenics. From the late 19th century until after the Second World War, this movement in Europe and North America aimed to enhance the genetic pool. Proponents of eugenics desired to eradicate 'genes for' those complex behaviours deemed undesirable, such as criminality, psychiatric disease and mental retardation. They sought to encourage those judged to have a superior genetic constitution to reproduce, whilst discouraged the 'genetically unfit' from so doing — sometimes involving involuntary sterilisation.[2]

In the United States, the first sterilisation law was passed in Indiana in 1907. Over the next ten years, fifteen more states passed legislation which empowered them to sterilise 'habitual or confirmed criminals, or persons guilty of some particular offence, like rape.'[3] A statute in Iowa went so far as to require the sterilisation of 'twice-convicted sexual offenders, of thrice-convicted other felons, and of anyone convicted just once of involvement in white slavery'.[4]

Following the human rights abuses of the Second World War and, eugenic practices of this nature rapidly and justifiably fell from favour. Not only was this movement based on questionable normative assumptions, it was bad science and exemplified crude genetic determinism.[5] Heredity is clearly not the sole causal determinant for human behavioural and mental traits, and state fair charts declaring that 'unfit human traits such as feeblemindedness, epilepsy, criminality, insanity, alcoholism, pauperism and many others run in families and are inherited in exactly the same way as colour in guinea pigs'[6] were rightly abandoned.

Following the discrediting of determinism, statutes sanctioning sterilisation of various groups (including criminals) were gradually repealed. However, attempts to establish a link between biology and criminal tendency continued during the 1960s and 1970s. For example, researchers aimed to establish a link between criminal tendency and the XYY karyotype; and criminal tendency and testicular size. These studies again were liable to criticism from an epistemological perspective, providing more shady milestones in the history of behavioural genetic research.[7]

Given the bleak history of behavioural genetics, public concern with research into criminal tendency is certainly understandable. It is likely that genetic influences on behaviour, if they exist at all, are so complex that any research undertaken will always be prone to a low level of accuracy.[8] This tendency to low accuracy may even lead to results derived from researcher bias (such as racism) rather than scientific rigour.[9]

Yet despite public concern, research into genetic influences on criminal tendencies has failed to decline. In fact, recent research suggests that a link between genetics and criminality is not only possible, but likely. And with the recent completion of the Human Genome Project, it is possible that more genes will be discovered to significantly influence our behaviour. In one family at least, this already appears to be the case.

III. The Dutch Family Criminal Kindred

III.1. Disproportionate Displays of Criminal Behaviour

The most compelling evidence of a genetic link to a form of criminal behaviour derives from the criminal profile of a Dutch family. For over 30 years, this family had recognised a disproportionate number of male family members exhibiting aggressive or violent criminal behaviour; including arson, attempted rape and exhibitionism.[10] Further, male relatives who never displayed this aggressive behaviour did not express *any* type of abnormal or criminal behaviour.[11] These observations prompted clinical geneticist Hans Brunner to search for a suspected 'aggression gene' in this family.[12] He observed that this aggressive and violent behaviour was specific to certain males in the kindred, and did not appear to be related to environment.[13] So far, Brunner has recorded fourteen men, spanning five generations, as exhibiting this characteristic behaviour.

The aggressive males in this family were also found to have mild mental retardation, whilst those who did not ever behave in such a manner exhibited 'normal' intelligence.[14] This lead Brunner to hypothesise that inheritance of this behaviour was X-linked. That is, the gene carrying the specific mutation is present on the X-chromosome, and as such will only manifest when not masked by a normally functioning copy of the gene on another X chromosome. As they carry only one X chromosome, male family members are more likely to exhibit this behaviour than females. Female family members are, however, liable to bear 'affected' sons.[15]

Yet while it appeared likely that there was an X-linked gene influencing the occurrence of this behaviour, it took some time for the specific gene to be found.[16] This was achieved using five affected males from the family, female members of the family (those suspected to be both carriers and non-carriers) along with unaffected and unrelated control individuals. The outcome of this linkage analysis was the identification of the likely region for the abnormal gene in this family, namely the Monoamine Oxidase (MAO) region.

III.2. The Monoamine Oxidase Hypothesis

The MAO region consists of two genes encoding two enzymes: monoamine oxidase A (MAOA) and monoamine oxidase B (MAOB). If they function as they should, these enzymes assist in the breakdown of neurotransmitters in the brain;[17] a process vital to the functioning of the nervous system. Enzymes like the MAOs are required to degrade neurotransmitters after they have performed their desired task. Brunner *et al.* suggested that in the Dutch family, MAO activity might be disturbed in those displaying deviant behaviour. This hypothesis was supported by urine analysis indicating a higher than normal amount of neurotransmitters being excreted by aggressive males — an observation consistent with a reduction in the functioning of MAOA.[18] A mutation was then identified in this family that resulted in the complete absence of functional MAOA enzyme.

A deficiency of MAOA results in a build up of neurotransmitters. Once they reach abnormal levels, this is thought to increase the probability of a person demonstrating an excessive, even violent, reaction to stress — a theory also demonstrated in knockout

mice.[19] Yet apart from the Dutch kindred study, no causal link has been suggested between overabundant neurotransmitters and behavioural disturbance in humans. It is possible that there is some other function of the MAOA enzyme that results in abnormal behaviour when disrupted. For example, it has been observed that MAOA deficiency results in a rapid eye movement (REM) sleep deprivation. Hence REM sleep deprivation is another result of MAOA deficiency and another possible cause of abnormal behaviour.

The example of the Dutch family provided circumstantial evidence for the MAOA hypothesis, but further evidence has also been found. In August 2002, a study was published by Caspi *et al.* suggesting a positive relationship between MAOA deficiency, violent crime and antisocial personality disorder in males. On four separate measures of violent, criminal or antisocial behaviour, it was found that males who were badly maltreated as children were significantly more likely to develop a tendency for these behaviours if they *also* expressed low MAOA activity.[20] Though this effect was displayed most dramatically in individuals who experienced childhood maltreatment, this study gives further support that the MAOA mutation is a significant risk factor for males developing violent or criminal tendencies.

Yet these suggestions of a link are still at risk of being a mere artefact, as demonstrated by another recent study which failed to identify a statistically significant number of MAOA mutations when certain target populations were screened.[21] Although this suggests that the MAOA mutation is not associated with all instances of abnormally aggressive behaviour, a link can still be inferred for cases such as the Dutch Family, or the study of Caspi *et al.* In such cases, the genetic mutation, though perhaps not a cause, can be seen as a significant risk factor for some kinds of violent criminal behaviour. While no definitive causal link has yet been established between monoamine oxidase deficiency and criminal behaviour, the above evidence nonetheless suggests a potential association between these factors.

IV. Behavioural Genetics Today

How should we respond if further evidence supports the MAO hypothesis?

One response, at least, is relatively straightforward. It has been suggested that perhaps even a simple adjustment to the diets of individuals with a MAOA mutation will help avoid triggering this abnormal behaviour — limiting the dietary intake of the amino acid precursors to the neurotransmitters may prevent a build-up ever occurring. Alternatively (or additionally), avoiding substances such as red wine may leave more MAOA in the blood to break down neurotransmitters, also preventing a build-up to excess levels. Drugs which block neurotransmitter activity may also be used to control their excessive functioning.

However, other responses are likely to be more controversial. As analysis of data from the Human Genome Project continues, some further links between genetics and human behaviour are sure to be suggested and replicated. Although our environment plays a significant role in determining our behavioural characteristics, our genetic constitution may also make a contribution (interacting with environmental factors)[22] — as the Dutch Family kindred suggests. This raises the spectre of genetic interventions being used to control violent behaviour. While the involuntary sterilisation of female

carriers (or any competent person) is certainly unconscionable, it may be possible for female carriers in the Dutch family to request a genetic intervention to ensure they do not bear sons with a mutated copy of the MAO gene.

Would this be immoral, like the eugenics of the Nazis? Before attempting to answer this question, it is important to note that while eugenics has now taken on a more normative flavour, associated with discrimination and rights violations, the original definition proposed by Galton was very different. In fact, Galton mostly proposed a voluntary eugenics, which would not interfere with anyone's reproductive autonomy or rights: carriers requesting not to have children with a MAO mutation would be just what he would have hoped for. This is the form of eugenics which we wish to consider here. What we therefore need to ask is whether, given its voluntary nature, this form of eugenics is acceptable: is it acceptable for parents to choose to use genetic technology to ensure that their children are born without a genetic pre-disposition to behaviours judged to be socially undesirable?

V. Eugenic Selection versus Eugenic Enhancement

How we should respond to a female carrier's request not to have a child with a MAO mutation will depend in part on our response to many of the objections to voluntary eugenics *as a whole*.[23] However, it may also depend upon the particular technology employed to meet the request. There are at least two ways in which a couple might have a child without a predisposition to this behaviour — genetic selection and genetic enhancement — and a moral difference in the status of these interventions may allow us to justify one over the other.

V.1. Genetic Selection

The first way in which a couple from the Dutch family might have a child without a predisposition to aggressive behaviour is to allow them to select, from the range of possible children they could have, a child without the MAO mutation. This could be achieved by undertaking mutation analysis in several embryos created via IVF technology, or by prenatal testing and termination of a pregnancy if the foetus had the mutation.

V.2. Genetic Enhancement

The second way to avoid bearing a child with the MAO mutation would be to genetically enhance the embryo — to alter the mutated genes before the embryo begins to divide. At present, germline genetic enhancements are not available.

Many people consider there to be a moral distinction between therapy and enhancement.[24] Some may object that the word 'enhance' connotes an non-therapeutic intervention which obtains a more desirable genome, in contrast to gene therapies, which correct genetic diseases and disorders. The question of what defines a genetic disorder is difficult to answer — especially when the disorder is behavioural — and we will not answer it here. For our purposes, enhancements will be used in a broader sense, encompassing any intervention which deliberately changes a subset of a person's genome. Ethical issues relating to 'supermen' or 'designer babies' are irrelevant here, because

using a genetic intervention to correct a pharmacological imbalance such as the one caused by the MAO mutation is no different in principle to treating the condition by replacing the deficient enzyme, or other environmental manipulations.[25] In either case, the result is that the neurochemistry of the person is changed in a particular way.

While the outcome of genetic selection and genetic enhancement is the same — a child being born without a (putative) genetic predisposition to criminal behaviour — the ethical ramifications of each procedure are very different, as we shall now demonstrate.

V.3. Harm to the Child as a Reason not to Select?

Harm to the child is often taken to be the foremost consideration in discussions of issues in genetic intervention. Indeed, legislation regulating assisted reproduction in both the United Kingdom and Australia mandates consideration of the interests of the future child before sanctioning couples' use of reproductive technologies.[26] It is, of course, possible that a child could be harmed by a genetic (or other) enhancement. Gene therapy or genetic selection may carry medical risks, though none have been discovered so far. The genetic predisposition to criminal behaviour may also predispose or contribute to other desirable behaviours, which would be lost if selection is undertaken.[27] Say a mutation is associated with a predisposition to manic-depression and that mild mania is associated with creativity and productivity. If a person's tendency to mild mania were removed, she might make a reasonable claim that she has been harmed — in addition to limiting her tendency for the 'disorder', her artistic potential has also been constrained. We might assume that a person would not complain if a predisposition to criminal violence were removed even if it did contribute to some other desirable trait, but we cannot know for sure. And when we change somebody's body in a way they dislike, unless they have given consent, it counts as a harm.[28]

In considering this type of harm, we contend that genetic selection is less potentially harmful to offspring than genetic enhancement. Consider again the above (currently fictional) case, where a mutation exists which predisposes a person to manic-depression. Imagine a couple want to have a child lacking the mutation. They undergo IVF, through which they produce six embryos. These are all genetically tested and four are found not to carry the mutation. One of these is selected and implanted. The embryo grows to be a child, who grows to be an adult, Vincent. Vincent looks at his cousins, who are famous artists and who have the mutation. Can he reasonably complain about what his parents did in selecting an embryo without the mutation? No, since if they chose any other embryo, it would not have been *him*. It would have been someone else. Insofar as his life is worth living overall, even if he is not a famous artist, he has no complaint about the selection procedure. If Vincent's parents had chosen another embryo, he would not have lived.[29] Leaving aside privacy issues for the moment, we don't require Vincent's consent for this procedure, because what happens to him is no different from what happens to a normal embryo when it is conceived and born.

Vincent's case presents a dilemma. To compellingly argue that he has indeed been harmed, he must be able to argue that the circumstances of his life are horrible indeed, because the only alternative for him is non-existence.[30] However, if Vincent's mutation predisposing him to manic depression were removed by genetic enhancement, rather than through genetic testing and selection of an unaffected embryo, he could have a

legitimate claim to having been harmed. Genetic enhancement (or genetic manipulation generally) affects an identifiable individual for better or worse. When considering a possibly-enhancing intervention, there are two possible futures for the *same person*.[31] If Vincent actually ends up worse-off than he would otherwise have been as a result of the enhancing intervention, he has been harmed and may have a legitimate complaint against his parents and/or doctors. Yet if Vincent is born from genetic selection, persons with and without the predisposition to manic depression would be different people. The selected-Vincent would not have existed but for his parents decision to select the embryo he developed from, and had his parents not undergone genetic selection, it is very unlikely that the very same sperm and egg would have met during a natural conception event. Hence, Vincent cannot be said to have been harmed by his parents' decision. He is not worse off than 'he would otherwise have been, as he wouldn't otherwise have been'.[32]

As discussed above, this problem arises because harm *to the child* is taken to be the foremost consideration in discussions of genetic interventions. That is, we adopt a *person-affecting* view of harm. According to a person affecting view of harm, a person is harmed by an act if she is made worse off than she would otherwise have been if that act had not been performed. According to an *impersonal* view, harm can occur from an act, if as a result of that act, there is less well-being in the world than there would have been if that act had not been performed. This is true even though no person is worse-off than she would otherwise have been.

Whether genetic selection is morally preferable to genetic enhancement will depend upon how important impersonal harm is, as opposed to person-affecting harm. In the case of the 'selected' Vincent, there is impersonal harm (harm which is worse for *no-one*), whilst the Vincent born of genetic enhancement has been harmed in a person-affecting way. Various theorists have suggested solutions to this dilemma. Parfit, for example, argues for the *no difference view*: adopting the (arguably commonsense) attitude that the 'two Vincents' have suffered equal harm, or at least that an equal wrong has occurred. Knowledge of the rational difference between selection and enhancement doesn't change our attitudes towards the wrongness of Vincent's parent's actions in causing him to exist without a predisposition he thinks he would have benefited from. Consequently, there should be no difference between a harming act that doesn't affect who is born (in this case, enhanced Vincent) and one that does (selected Vincent), provided that in each instance, the same number of people exist.[33] It would have been better overall had the selected Vincent's parents acted differently, even if this would have meant that Vincent would not have existed — and selection is not immune from criticism.[34]

The alternative view is, however, also very plausible — and, we think, ultimately preferable. McMahan argues (and we agree) that there can be 'some difference' between cases akin to genetic selection and genetic enhancement, justifying it in terms that an effect can still be bad even if it is not worse for anyone, 'but not as bad as it would be if it *were* worse for someone'.[35] Impersonal considerations do matter, but person-affecting considerations matter more.

On this view, there is a morally significant difference between selection and enhancement, such that selection is morally preferable to enhancement, at least in terms of harm reduction. Both selection and enhancement have caused Vincent to feel aggrieved at a perceived quality his cousins have that he does not.

However, McMahan has refined his 'some difference' view to an *Encompassing Account*.[36] On this view, person-affecting and impersonal considerations may not have a great practical difference: they are distinct and non-additive, with neither type reducible to the other. Both person-affecting and impersonal considerations matter and can provide us with reasons for action. Even if an effect is worse only impersonally, then this can still provide a reason to prevent a particular act from taking place. He argues:

> The Encompassing Account holds that, when this effect is worse for the child as in the . . . [enhancement case] *that* fact provides whatever reasons there are to prevent it. That the effect is also worse impersonally is irrelevant. Yet, when the effect is worse only impersonally, as in the . . . [selection case], that fact provides a reason to prevent it.[37]

That is, practically, the two cases should be treated in a similar way, as the moral difference between them is unlikely to be more than very slight.[38]

Does this mean that if harm is possible, then given the slight moral difference between selection and enhancement, neither should be attempted? Overall, we believe that the correct position is that which reflects McMahan's initial view: selection is preferable to enhancement. Asserting that selecting people is as wrong as enhancing people is unlikely to be true in reality; as experientially, were Vincent to find out about an enhancement, it is likely that he would suffer greater harm if he realised that he could have not been so enhanced and still could have lived. Although Vincent feels aggrieved in both the selection and enhancement cases, enhancement can be said to be *more wrong* than selection. However this is not to say that selection which foreseeably results in more harm than benefit is justifiable — it should still be discouraged from an impersonal point of view.

Provided this argument applies in the general case (and we see no reason why it could not), we therefore conclude that genetic selection is more immune than genetic enhancement to arguments which depend on the concept of harm to the child from the genetic choice made by the parents. In fact, this argument holds true *regardless* of how misguided the parents' genetic choices may turn out to be, provided only that the child has a life worth living. Given the differences in harm to the child, we may conclude that enhancement is likely to turn out to be more ethically problematic than selection. Yet a number of objections remain to the kind of eugenic intervention involved in Genetic selection. If these are irrefutable, genetic selection may lose its immunity to harm arguments.

VI. Other Concerns with Eugenic Selection

VI.1. Harm Resulting from Selection

It is sometimes claimed that the process of genetic testing would cause harm to the child, whether selection or enhancement is eventually used to make the genetic choices. The first of these concerns relates to the medical process of testing the embryos. For example, it is believed (but not firmly established) that there are some minor risks to the embryos involved in some prenatal tests for Downs' syndrome.[39] Since these risks are contingent on the particular process used to genetically screen the embryos, we

need not prohibit genetic selection on this basis, since less harmful techniques could always be substituted.

Another concern is that screening for behavioural traits detracts from a child's autonomy. By making knowledge about a person's genetic characteristics available to them, it is sometimes argued that we limit the number of choices which appear rational to the person, thus removing the child's 'right to an open future'. An important source of such arguments is Joel Feinberg's *Freedom and Fulfilment*. His claim is that parents have a duty to promote their child's adult ability to make important choices about his or her life.

There are three things to say on this matter. First, it must be stressed that one's genes are not direct determinants of one's behaviour. Because of this, one's *knowledge* of one's genes can certainly not be a direct determinant of one's behaviour — psychological influences upon subsequent behaviour caused by this knowledge aside. Knowing I have a constellation of genes associated with having talent at being an artist does not make me become an artist, even if such knowledge makes it appear a good choice.

Second, even supposing that such knowledge did force one to make particular choices, there is ample controversy over whether this would constitute a reduction in one's autonomy. Harris, for example, claims that autonomy is limited by defects in the information one uses to make choices.[40] For Harris, uninformed choices express less autonomy than informed choices. Autonomy is about self-determination — choosing a path in life which one judges is best. This requires both relevant knowledge about the options and the nature of oneself. Self-knowledge, including genetic self-knowledge, is essential information to being fully autonomous.

Third, Feinberg himself argues that when a person's choice will be clearly against their interests, we are 'justified in interfering with his liberty in order to protect him from harm'.[41] Given that compulsive violent or criminal behaviours are typically punished with incarceration as well as social rejection, we can assume that these behaviours typically harm a person who expresses them, as well as their victims. Selections which constrain a person from making such harmful choices may therefore be justified. Therefore this type of selection choice is justified on the basis of protection of the interests of others.

When it comes to performing tests on adults, such as drug tests, we usually would require the person's consent, all things being equal, for reasons of privacy. As discussed above, the embryo's consent is unavailable. Can the selected embryo complain, once it grows up, that its privacy was violated? Possibly. But there are two mitigating factors. First, babies have their privacy violated in this way all the time. In fact, it is widely assumed that children have little desire or need for this kind of privacy. Second, a privacy violation seems a much less serious outcome than the production of a baby with extreme violent tendencies. Perhaps this consent concern may prevent us from intervening in the case of trivial genetic characteristics, but it cannot prevent us from trying to avoid very bad outcomes for the child.

Finally it is often feared that genetic interventions will lead to the selected children facing an intolerable weight of expectation from their parents. We could ignore this effect in the case of screening for violent tendencies, because the majority of parents already expect their children not to manifest any such clearly undesirable social behaviour. But let us address this problem in the general case, where it is feared that people

with particular genes may face abnormally high or low expectations for their behaviour. It is claimed that genetic testing would lead to a world in which people with genes correlated with violent behaviour could be incarcerated to prevent the crimes, or in which people with these genes could use genetics as a way of freeing them of responsibility for their crimes. Parents might expect miracles from their children, and the children may suffer from this expectation.

Both parents who overestimate their child's likely actions, and law enforcement agencies who underestimate a person's likely behaviour based on their genes, would be acting on a deterministic understanding of genetics which is false. Even if a deterministic account of behaviour is true, genetics form only one cause from a very long list of causes which lead to any given behaviour. Our genes, therefore, do not determine our behaviour, even when they are in fact producing known behaviour-altering chemical effects. Jonathan Glover puts it this way:

> Of course there are environmental factors, so if one says there is a disposition which is irresistible, one does not mean it is irresistible all the time, but that there are certain contexts where it may be. . . . Our abilities come and go, they vary a lot according to different contexts, and there may not be a black-and white answer to the question of whether this person could have acted differently.[42]

In order to avert unrealistic deterministic expectations from law-enforcers or parents, some degree of education on this matter may be necessary. Present ignorance in the population does not provide sufficient reason to reject eugenic selection.

VI.2. Social Harm

The remaining group of objections that may be raised against selection, is the group of objections that deals with *social*, or *distributed* harms. In these objections, it is claimed that genetic selection commits a harm on a large group of people, though perhaps each person suffers only mildly. Such claims are not affected by the identity of the people harmed, as in the case of Vincent, because if a large group is harmed, genetic interventions on any individual cannot seriously affect the identity of that group. Even if we regard harm to the child as our paramount concern, we should not completely ignore questions of social harm, if only because it is the social benefits of eugenics which are often seen as the primary benefit.

VI.2.1. Diversity

Consider again the case of Vincent. One example of a social harm objection is the objection of reduced diversity. This is the claim that, while Vincent is not harmed, everybody else is slightly worse off for Vincent's parents deciding to have an non-manic, untalented child. Some fear that, while an individual couple's choice might have no perceptible effect on social welfare, if their choice became dominant, then we might soon find ourselves in a world with no talented artists.

The evidence does not seem to indicate that there is a real threat of such an extinction, however. Even in real-world selection cases involving parents testing embryos for Downs' Syndrome, about ten per cent of the couples who have a positive test for the syndrome choose to proceed with the pregnancy.[43] Many parents have made

this choice in spite of the fact that their child's welfare is forseeably worse than if they created a new embryo. It therefore seems unlikely that any given selection choice would eradicate a particular trait completely. In any case, not all couples will be able to produce embryos unaffected by any undesirable genetic trait.

If we are not threatened with the eradication of genetic features through selection, we may still be concerned that, by making misguided choices, we will change the existing balance of genetic qualities in a way which performs some level of social harm. For example, there is a strong correlation between violently criminal behaviour and a person's gender.[44] We might reasonably hope that the incidence of violent crime would be reduced, if we selected mainly, but not only, female embryos. We may be reasonably apprehensive that this kind of gender imbalance will cause harm to one or both of the gender groups. For example, it is possible that in a world with a large gender imbalance, one or the other of the gender groups would experience (even more) discrimination.

Choices like this gender choice constitute a particular type of selection. Before we try to make sense of this gender imbalance objection, let us consider the types of discrimination which result from the more general case of genetic selection.

VI.2.2. Discrimination/Devaluation

Often the objection is made that, if some particular selection choice became a dominant choice for the eradication of some particular trait, then those who are born carrying the unwanted trait would be discriminated against, or devalued. While A may not be harmed by having genetic constitution G, A may be harmed by another couple selecting B with genetic constitution G. Imagine that, if selection were not allowed, A would be the tallest man in the world. If selection were allowed, there would be many people A's height. A may be harmed by allowing selection. Or C, who lacks genetic constitution G, may be harmed by allowing genetic selection because in such a world, C is very short. In a world without selection, C would be average height.

This kind of objection cannot be made to apply to the case where we are selecting to eradicate a tendency for violence or criminality. By substituting these terms into the above general case we get an untenable argument — it seems that it would be impossible to harm someone by making them relatively less violent than everyone else. We might be concerned, instead, that children of parents who choose not to use the selection technology would be discriminated against due to the presence of the unwanted violent gene.

This concern, too, is less relevant in the case where criminality is the targeted behaviour. Those who express violent or criminal behaviours are shunned and devalued by society, whether their criminal tendencies are genetic or learnt. This is because criminal behaviour is almost unanimously devalued. Parents will find that their children are vilified and punished for violent acts, regardless of whether these acts could have been prevented by genetic selection. As Glover notes, we may have difficulty justifying retributive punishment for crimes which are thought to be largely genetic in origin.[45] Yet there is no way for fundamentally anti-social behaviours, such as criminal violence, to become acceptable in a society. It is therefore hard to believe that either the individuals born with the technology, or the individuals born without it, would be treated any worse if eugenic selection were used to reduce the incidence of genetically-based criminality.

This argument may be extended to behavioural and non-behavioural traits other than violence or criminality. The vast majority of human qualities are not in 50/50 equilibrium. There are a great many minority qualities which are not discriminated against, and only a few which are. This indicates that the cause of any particular case of discrimination is unlikely to be the minority status of the victims. Given that this is the case, if we are concerned that selection will increase a certain type of discrimination, we should instead pursue relevant options for eliminating the prejudices which create the discrimination. We should in fact do this *whether or not* we proceed with genetic selection.

We may now return to the proposition, above, of selecting female embryos to diminish the incidence of violent crime. It is certainly possible that a world with far fewer men than women would result in discrimination against men, whether they are criminal or not. We have now eliminated the claim that potential discrimination would give us sufficient reason to reject genetic selection. But it is also possible that harms would result, *even if* prejudice and discrimination were eliminated in such a world. For example, it may become more difficult for women to find a procreative mate, or for men to find shoes which fit. It is conceivable, at least, that people living in such a world might wish that their parents' generation had not chosen mainly females.

We suggested above that this case is an instance of a particular type of selection. The difference between this and the MAOA case is that no attempt is made in this gender-selection case to avert the social ill-effects of the selection. Since any one particular unwanted genetic trait is not specifically selected by selecting entire chromosomes, the parents would also be responsible for all of the other effects of the selection, which could not be fully considered until the behavioural and social effects of *every gene* on the X and Y chromosomes are understood. This would be a gargantuan task.

In the case of the MAOA mutation, by contrast, the risks of social harms are highly controlled. First, the proposed genetic change is minimal in extent. A theory has been advanced to explain the biological function of the gene in question, and further clinical evidence may provide a clear causal relationship between the gene and behaviour in question.

Second, we have been able to advance a number of arguments particular to the behaviour of criminality, which should convince us that no social harms will ensue as a result of widespread selection. These particular arguments will, on the whole, be stronger than the general arguments about behavioural selection which accompany them. For any given genetic trait, these are exactly the sort of case-specific arguments we should consider, to control the risks of social harm from widespread genetic selection against that trait.

If we only act in these sorts of cases, then we may control the risks of social and individual harm. It may still turn out that some terrible social harm results from the *reduction*, not the extinction, of some particular gene, in some surprising and unforeseeable way. Perhaps, for example, a certain number of violent criminals are required for societies to function. The risks of this, however, seem small enough to be utterly outweighed by the foreseeable good outcome.

Any technology is made more risky when it is used without concern for the outcomes. This is true of knives and hammers, and it is true of genetic selection. What the MAOA case shows is that genetic selection is a tool which can be used in a controlled way which minimises the risk of social and individual harms.

VIII. Conclusion

Behavioural genetics certainly raises difficult ethical dilemmas. One such dilemma is the extent to which it is reasonable to interfere in the behavioural predispositions of future generations. Through considering the example of the Dutch criminal kindred, this paper has discussed whether genetic selection may be morally preferable to genetic enhancement. We have argued that if concern about harms is paramount, then objections against eugenics are more difficult to sustain when genetic selection is employed. Further, objections to voluntary eugenics which are not met by the use of this technique can be ameliorated if appropriate care is taken when employing genetic selection, such as a discouragement of social prejudice against criminal tendency.

We recognise that despite this, two potential moral impediments remain: the concern for the child's right to an 'open future', and concern for violation of Natural Law. However, these objections are predicated on highly controversial premises, and intervention in the former remains permissible for clearly harmful genetic traits. In fact, most objections to selection that have been considered are substantially weakened where the characteristic being selected against is a tendency towards an undesirable and antisocial behaviour, such as criminality.

Therefore, there seems little reason to withhold new genetic tests enabling carriers of these mutations to have children without the disposition to these behaviours if they so choose.

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NOTES

1 See, for example: J. S. Alper, 'Genes, free will, and criminal responsibility', *Social Science and Medicine* 46, 12 (1998):1599–1611; J. R. Botkin, W. M. McMahon and F. Leslie (eds.) *Genetics and Criminality: the Potential Misuse of Scientific Information in Court* (Washington, DC: American Psychological Association, 1999); D. Wasserman and R. Wachbroit (eds.) *Genetics and Criminal Behaviour* (Cambridge, Cambridge University Press, 2001).
2 The case of Carrie Buck's sterilisation is but one example: J. D. Smith and K. R. Nelson, *The Sterilization of Carrie Buck* (Far Hills, NJ: New Horizon Press, 1989).
3 Kevles op. cit., p. 100
4 *Ibid.*
5 D. Wikler, 'Can we learn from eugenics?', *Journal of Medical Ethics* 25, 2 (1999): 183–94.
6 Kevles op. cit., p. 62.
7 E. Boisen, 'Testicular size and shape of 47, XYY and 47, XXY men in a double-blind, double-matched population survey', *American Journal of Human Genetics* 31, 6 (1979): 697–703.
8 Indeed, difficulties have already arisen in replicating research results in traits such as homosexuality and intelligence. Although a quantitative trait loci associated with intelligence was published in 1998, a failure to replicate this original finding has recently been reported: L. Hill, M. J. Chorney, D. Lubinski, L. A.

Thompson, and R. Plomin, 'A quantitative trait locus not associated with cognitive ability in children: a failure to replicate', *Psychological Science* 13, 6 (2002): 561–2.

9 For example, one recent display of concern over the implications of this kind of research occurred in response to a conference that proposed to discuss the role of genes in violent behaviour. The 1992 conference, which was to be held in Washington, was bombarded with criticism over claims that the meeting content would include racist overtones: V. Kiernan, 'Panel hears conflicting views on biology of violence', *New Scientist* 138, 1877 (1993): 7. As a result, the National Institute of Health was forced to withdraw funding for the conference. When it proceeded three years later, the conference was dominated by protests and semantic arguments over words such as 'crime', 'heritability' and 'biological': L. Goodman, 'Crime and genetics conference breeds further controversy', *Nature* 377 (1995): 276. More recently, the issue of criminality was judged serious enough by the Nuffield Council on Bioethics that a significant portion of its inquiry into behavioural genetics was dedicated to the issue of genetic influences on criminal tendency and what this may mean for explanations of moral responsibility: Nuffield Council on Bioethics, *Genetics and Human Behaviour: The Ethical Context* (London: The Council, 2002). Available at: http://www.nuffieldbioethics.org (accessed 28 May 2003).

10 In fact, it was a female family member who reported this apparent familial trait to geneticist Hans Brunner in 1978: V. Morell, 'Evidence found for a possible "aggression gene"', *Science* 260 (1993): 1722–1723.

11 The 'unaffected' males reported difficulties in understanding the behaviour of their brothers and cousins; and sisters of the males who demonstrated these aggressive outbursts reported intense fear of their brothers. In one incident, one of the affected males responded to an innocuous request made by his sister by holding a knife to her throat, threatening to harm her.

12 H. G. Brunner, M. R. Nelen, P. van Zandvoort, N. G. G. M. Abeling, A. H. van Gennip, E. C. Wolters, M. A. Kuiper, H. H. Ropers, and B. A. van Oost, 'X-linked borderline mental retardation with prominent behavioural disturbance: phenotype, genetic localization, and evidence for disturbed monoamine metabolism', *American Journal of Human Genetics* 52, 6 (1993): 1032–1039.

13 The behaviour of those affected has been documented for almost forty years ago by an unaffected maternal grandfather who could not understand why some of the men in his family appeared to be prone to this type of behaviour.

14 H. G. Brunner, M. Nelen, X. O. Breakefield, H. H. Ropers, and van B. A. Oost, 'Abnormal behaviour associated with a point mutation in the structural gene for Monoamine Oxidase A', *Science* 262, 5133 (1993): 578–580.

15 As females have two X-chromosomes, a female would require a mutated copy of the gene on both of her X-chromosomes to be 'affected'. However, as males have only one X-chromosome, carrying the gene on their X-chromosome may be sufficient for the aggressive condition to manifest at some point during that person's life. Males who have the disorder must have inherited the affected gene from their mothers, who can be referred to as 'carriers' of the trait.

16 The gene was eventually mapped using known genetic markers on the X chromosome. This practise is based on the understanding that if a known marker is constantly being inherited in people affected by a particular condition, then the marker must be linked to the gene causing it.

17 Neurotransmitters play a key role in the conduction of nerve impulses along our neural networks.

18 Further biochemical analysis revealed that the functioning of MAOB functioning was normal, a surprising result as a deficiency in MAOB had been previously linked to pathological behaviour: M. S. Buchsbaum, R. D. Coursey, and D. L. Murphy, 'The biochemical high-risk paradigm behavioural and familial correlates of low-platelet monoamine oxidase activity', *Science* 194, 4262 (1976): 339–341.

19 Studies that have created transgenic mice completely lacking the function of the monoamine oxidase gene report an increased level of aggression in the behaviour of the mice: O. Cases, I. Seif, J. Grimsby, P. Gaspar, K. Chn, S. Pournin, U. Müller, M. Aguet, C. Babint, J. Chen Shih, and E. De Maeyer, 'Aggressive behaviour and altered amounts of brain serotonin and norepinephrine in mice lacking MAOA', *Science* 268, 5218 (1995): 1763–1766.

20 Subjects were selected from the Dunedin Multidisciplinary Health and Development Study, which controlled for the environmental factor of social stratification. The study also controlled for childhood maltreatment, which is considered the most significant environmental determinant to violent and criminal behaviour: A. Caspi, J. McClay, T. E. Mofitt, J. Mill, J. Martin, I. W. Craig, A. Taylor and R. Poulton, 'Role of genotype in the cycle of violence in maltreated children', *Science*, 297, 5582 (2002): 851–854.

21 D. E. Schuback, E. L. Mulligan, K. B. Sims, E. A. Tivol, B. D. Greenberg, S. Chang, Y. Mau, C. Shen, M. Ho, N. Yang, M. G. Butler, S. Fink, C. E. Schwartz, F. Berlin, X. O. Breakefield, D. L. Murphy and Y. P. Hsu, 'Screen for MAOA mutations in target human groups', *American Journal of Medical Genetics* 88, 1 (1999): 25–28.
22 For discussion, see: A. Newson, 'The nature and significance of behavioural genetic information', In press (2003).
23 For review, see: A. L. Caplan, G. McGee and D. Magnus, 'What is immoral about eugenics?', *British Medical Journal* 319, 7220 (1999): 1284–85.
24 D. B. Resnick, 'The moral significance of the therapy-enhancement distinction in human genetics.' *Cambridge Quarterly of Healthcare Ethics* 9, 3 (2000): 365–77.
25 For an opposing view, see: R. Cole-Turner, 'Do means matter?' in E. Parens (ed.) *Enhancing Human Traits: Ethical and Social Implications.* (Washington, DC: Georgetown University Press, 1999). Additionally, despite our argument that means do not matter in this context, it does not necessarily follow that means will never matter in *any* context of genetic intervention.
26 For example, the UK *Human Fertilization and Embryology Act 1990* (s. 13(5)).
27 A phenomenon known as 'pleiotropy'.
28 E. Vermeersch, 'Individual rights versus societal duties', *Vaccine* 17 (1999): S14–17 at p. S16. Embryos cannot give their consent, so their parents are legally and ethically permitted to consent for them when medical procedures are necessary; however there is no reason to assume that a person will be completely forgiving of an unwanted, unconsenting procedure of any nature, purely because it was performed when they were an embryo. Parents therefore are often forced to risk harming their children when allowing even completely necessary medical procedures to be performed.
29 This echoes the 'non-identity problem', as famously discussed by Derek Parfit: D. Parfit, *Reasons and Persons* (Oxford: Oxford University Press, 1984), pp. 358–9. Further philosophical discussions of this problem can be found in: M. Hanser, 'Harming future people', *Philosophy and Public Affairs* 19, 1 (1990): 47–70; and J. Woodward, 'The non-identity problem', *Ethics* 96 (1986): 804–31.
30 This point has not been lost to other commentators. See, for example: B. Steinbock, and R. McClamrock, 'When is birth unfair the child?', *Hastings Center Report* 24, 6 (1994): 15–21.
31 Vincent would exist regardless of whether his parents decided to remove his predisposition to manic depression, as the majority of his genetic constitution would remain unaltered.
32 D. Parfit, D. 'Rights, interests, and possible people' in S. Gorovitz (ed.). *Moral Problems in Medicine* (Englewood Cliffs, NJ: Prentice-Hall, 1976), p. 374.
33 Parfit supports this view with the 'Same number quality claim': Parfit, (1984) op. cit., p. 360. This is a new, impersonal theory, not resting on personal interests.
34 A similar view is also taken by Dan Brock: D. W. Brock, 'The non-identity problem and genetic harms: the case of wrongful handicaps', *Bioethics* 9, 3/4 (1995): 269–75.
35 J. McMahan, 'Wrongful life: paradoxes in the morality of causing people to exist' in J. Harris (ed.) *Bioethics* (Oxford: Oxford University Press, 2001), p. 473.
36 *Ibid.*, p. 474.
37 *Ibid.*
38 *Ibid.*, p. 475.
39 Congress of the United States Office of Technology Assessment, *Biology, Medicine and the Bill of Rights: Special Report*, OTA-CIT-371 (Washington, DC: U.S. Government Printing Office, 1988), pp. 45–46.
40 J. Harris, *The Value of Life* (London: Routledge, 1985), p. 201.
41 J. Feinberg, *Freedom and Fulfilment* (Princeton, NJ: Princeton University Press, 1992), p. 92.
42 J. Glover, 'The implications for responsibility of possible genetic factors in the explanation of violence' in G. R. Bock and J. A. Goode (eds.) *Genetics of Criminal and Antisocial Behaviour* (West Sussex: John Wiley & Sons, 1996), p. 240.
43 N. J. Wald, A. Kennard, A. Hackshaw and A. McGuire 'Antenatal screening for Down's Syndrome', *Journal of Medical Screening* 4, 4 (1997): 181–246.
44 R. M. Wettstein, 'Violence and mental illness: additional complexities' in J. R. Botkin, W. M. McMahon, and L. P. Francis (eds.) *Genetics and Criminality* (Washington, DC: Psychological Association, 1999) p. 111.
45 J. Glover, 'The implications for responsibility of possible genetic factors in the explanation of violence' in G. R. Bock and J. A. Goode op. cit., p. 243.