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Selecting against disability: The liberal eugenic challenge and the argument from cognitive diversity

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Selecting against disability: The liberal eugenic challenge and the argument from cognitive diversity

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ABSTRACT *Selection against embryos that are predisposed to develop disabilities is one of the less controversial uses of embryo selection technologies (ESTs). Many bio-conservatives argue that while the use of ESTs to select for non-disease-related traits, such as height and eye-colour, should be banned, their use to avoid disease and disability should be permitted. Nevertheless, there remains significant opposition, particularly from the disability rights movement, to the use of ESTs to select against disability.*

In this paper we examine whether and why the state could be justified in restricting the use of ESTs to select against disability. We first outline the challenge posed by proponents of 'liberal eugenics'. Liberal eugenicists challenge those who defend restrictions on the use of ESTs to show why the use of these technologies would create a harm of the type and magnitude required to justify coercive measures. We argue that this challenge could be met by adverting to the risk of harms to future persons that would result from a loss of certain forms of cognitive diversity. We suggest that this risk

establishes a pro tanto case for restricting selection against some disabilities, including dyslexia and Asperger's syndrome.

INTRODUCTION

Some reproductive technologies, such as pre-implantation genetic diagnosis (PGD), allow parents to choose whether or not to gestate an embryo to term based on the presence or absence of particular genes. We refer to such technologies as embryo selection technologies, or ESTs. One of the least controversial applications of ESTs is their use in selecting against embryos that are predisposed to develop a disease or disability,¹ a practice sometimes known as disability screening. Many scholars argue that while the use of ESTs to select against non-disease-traits, such as normal short stature or a particular eye-colour, is morally impermissible, their use to avoid disease and disability is permissible. Robert Sparrow, for instance, argues that

The relevant standard against which to measure proposed interventions is a conception of normal human capacities This way of thinking about the ethics of shaping future persons, then, allows that the distinction between therapy and enhancement properly plays a crucial role in thinking about this issue.²

A similar view is expressed by Michael Sandel in his article 'The Case Against Perfection'. Having suggested that using ESTs to select against non-disease traits is problematic because it fails to appreciate children as 'gifts', Sandel qualifies his claim with the rider that

To appreciate children as gifts or blessings is not, of course, to be passive in the face of illness or disease. Medical intervention to cure or prevent illness.... does not desecrate nature but honours it.³

The view that it is permissible for parents to use ESTs to prevent disability in their future children, but not to select against non-disease-related traits, might be thought to justify the legal status of PGD in many jurisdictions around the world. In the UK, Australia, and parts of the USA and Continental Europe, parents are permitted to use PGD to select against disabilities and diseases such as Down

syndrome and cystic fibrosis, but not to select against non-disease traits like normal short stature.

In this paper we discuss the conditions under which it would be acceptable for the state to go further and restrict disability screening. In Part 1 we outline what we call the liberal eugenic challenge to opponents of disability screening. According to this challenge, those who hold that the state should restrict parental access to ESTs must show how the use of these technologies would create a harm of the type and magnitude required to justify coercive interference by the state. In Part 2 we investigate two common arguments against disability screening: the expressivist argument and the reduced resources argument. We argue that these arguments are unlikely to provide an adequate response to the liberal eugenic challenge. In Part 3 we suggest that it may be possible to meet the liberal eugenic challenge by invoking harms to future people, and in Part 4, we introduce a novel variant of the oft-mentioned diversity argument which does precisely that. This argument appeals to the instrumental value of certain disabilities in protecting future people against catastrophes – a value we illustrate by reference to Asperger’s syndrome and dyslexia. Finally, in Part 5, we draw out the implications of this argument for the justifiability of coercive state interference in disability screening.⁴

1. The Liberal Eugenic Challenge

Proponents of ‘liberal eugenics’ hold that, out of respect for reproductive freedom, prospective parents should be granted a wide sphere of free choice regarding the use of reproductive technologies, including ESTs.⁵ Free parental choice with respect to the use of reproductive technologies, including ESTs, is seen as an aspect or natural extension of the personal freedoms normally granted to individuals in a liberal democracy. One of the earliest descriptions of such an approach is found in Robert Nozick’s *Anarchy, State, and Utopia*. Nozick advocates a ‘genetic supermarket’:

Consider ... the issue of genetic engineering. Many biologists tend to think the problem is one of design, of specifying the best types of persons so that biologists can proceed to produce them. Thus they worry over what sort(s) of person there is

*to be and who will control this process. They do not tend to think, perhaps because it diminishes the importance of their role, of a system in which they run a "genetic supermarket," meeting the individual specifications (within certain moral limits) of prospective parents ... This supermarket system has the great virtue that it involves no centralized decision fixing the future of human type.*⁶

Although most writers in the liberal eugenic tradition accept that there should be some restrictions placed on the use of ESTs, they believe that any deviation from reproductive freedom requires a justification, and a justification of a certain kind. Given that there will be some private companies willing to provide access to ESTs, and some individuals who are willing to pay for such access, restrictions on parental use of ESTs would involve interference with voluntary transactions between consenting and autonomous adults. According to standard liberal principles, such interference could only be justified if the transactions could be expected to result in harm to third parties.⁷

Moreover, this harm would need to be of a particular kind and magnitude. On most liberal theories, some harms are outside the purview of the state in the sense that those harms generate no reasons for state intervention. For example, many acts of adultery harm third parties. However no matter how harmful these acts are, most liberals would deny that the state could justifiably use coercive measures to interfere with adulterous actions. Harms due to adultery lie beyond the purview of the state.⁸ Further, even when a harm does lie within the purview of the state, it may lack the moral weight required to justify coercive state interference; that is to say, the reasons for state interference that it generates may be defeated. For instance, harms that are very small in magnitude will typically not justify coercive state interference.

The challenge posed by liberal eugenics is, then, to show why the use of ESTs along the model of the genetic supermarket would cause harm to third parties, and harm of the type and magnitude required to justify coercive state interference.

One might, of course, seek to resist this challenge by denying that it is supported by liberal principles, or denying that those principles are correct. In what follows, we will not consider these possibilities. Instead, we direct ourselves to political

liberals who would accept the challenge. Our aim will be to consider whether such liberals can give an argument for restrictions on disability screening that meets the challenge. We begin, in the next section, by considering two of the most common criticisms of disability screening, both of which can be construed as pointing to harms that this practice will cause to existing disabled individuals.

2. Common criticisms of disability screening

2.1 The Expressivist Argument

One argument often advanced in support of the claim that disability screening is morally impermissible is the so-called expressivist argument.⁹ The expressivist argument claims that when parents choose not to implant an embryo because it is predisposed to develop a disability, they express an immoral or otherwise objectionable attitude toward existing disabled individuals. Specifically, they express the judgment that the disabled person is *worse* or in some way *less worthy of existence* than other persons.

At least two variants of the expressivist argument can be distinguished. One variant does not engage the liberal eugenicist challenge, since it does not claim that selection against disability is harmful. On this variant, selection is impermissible, but it is impermissible not in virtue of any harms that it causes but in virtue of the character flaws it manifests. One suggestion might be, for example, that expressing the judgment is impermissible because it manifests a willingness to too quickly infer a global evaluation of a person on the basis of a single fact: that the person carries (or will carry) a genetic predisposition to a disability.¹⁰

On a second variant of the expressivist argument, expressing a negative judgment about disabled people is impermissible because it *harms* those about whom the negative evaluation is made.¹¹ Since it invokes harms to third parties, this variant is inherently more suited to meeting the liberal eugenic challenge. Nevertheless, doubts could be raised as to whether it meets it.¹²

There are at least two different ways in which people with disabilities may be harmed by the expression of the judgment that they are worse or less worthy of existence than other persons. First, they may be distressed by the expression of this judgment; they may, that is, suffer a form of mental harm. Second, it might be thought that being the object of such a judgment is objectively harmful, regardless of whether one takes it to heart, or is even aware of it, for example because being outwardly valued by others is a component in the good life.

It is, however, not clear that these harms have sufficient moral weight to justify coercive state interference. Indeed some forms of distress are arguably harms of a kind that have no bearing on the permissibility of state interference.

Homosexuality and public displays of affection by mixed race couples can cause substantial distress to some, yet few liberals would take such distress as a ground for coercive state interference.

It might be objected that this is because the distress, in these cases, is unreasonable in the sense that it is grounded on unreasonable moral views. *Reasonable* distress, it might be thought, *could* ground coercive state interference. Yet even reasonable distress is seldom regarded a sufficient ground for coercion. For example, mildly violent films and statements of controversial but reasonable moral views can cause reasonable distress, but liberals would not take this to make them serious candidates for coercive state interference. Reasonable distress is, we think, a harm of a kind that could justify coercion – it is a *ground* for coercive state interference – but the distress would, we think, need to be exceptionally severe in magnitude for the ground to be sufficient.

Similarly, even if expressing the judgment that another person is of low value or worth is objectively harmful to that person, it is generally not sufficient to warrant coercive state interference in a liberal society. Statements such as ‘the unemployed are lazy dole-bludgers’ and ‘homosexuals are morally depraved’ are plausibly objectively harmful to those to whom they are directed, yet, though most of us find such statements to be highly objectionable, few would take coercive state interference with them to be justified in a liberal state, and not merely because of difficulties with enforcement.

It is true that the expression of negative attitudes toward others is sometimes seen as an appropriate object of coercive interference by the liberal state. This is most clearly reflected in anti-hate speech legislation which, in many jurisdictions, outlaws speech acts that promote hatred based on race, religion or ethnicity. It should be noted, however, that it is controversial whether such legislation can, for the liberal, be justified purely in virtue of the distress or objective harms that it directly causes to those to whom the hate speech is directed; it may be justified in whole, or in part, on the basis that hate speech promotes violent acts against disenfranchised groups and individuals.

Given that it is controversial whether even hate speech can permissibly be subjected to coercive state interference in virtue of the direct harms that it inflicts on its targets, it seems at the very least doubtful whether the harm-based variant of the expressivist argument will meet the liberal eugenic challenge. It seems doubtful that the harms it invokes are of the kind and magnitude required to justify coercive state interference.

2.2 Reduced resources

Another way in which disability screening may be harmful to those suffering from a disability is by reducing the total number of disabled people. This reduction in numbers may reduce the incentive for governments or charities to invest in other forms of support for disabilities.

As a hypothetical example, if the number of wheelchair-users in a population is high then there is a significant incentive for the state to make sure that there are ramps and accessible entrances in most public buildings. Wheelchair users may constitute a substantial proportion of the electorate, creating a direct political incentive for a democratically elected government to provide these facilities. Moreover, since they would benefit a large number of people, many non-disabled people may take there to be a strong moral case for building the facilities, and since the economic productivity and thus tax contributions of many would be adversely affected by the absence of the facilities, there might also be a significant economic incentive for the non-disabled to support investment in them.

On the other hand, if the number of people who require wheelchair access is very low, then the political case for spending money on this infrastructure in order to court votes from the disabled community weakens. Similarly, in such circumstances many non-disabled persons are likely to view the moral and economic arguments for building the infrastructure to be weaker. However, the cost of building the infrastructure will presumably remain unchanged. Thus, we might expect that, as the number of wheelchair-users falls, the net incentive for the government to provide wheelchair access will diminish, and thus the level of access enjoyed by each wheelchair user could also be expected to fall.

More generally, it might be argued that as the number of people with a disability falls, the quality of facilities provided will tend to fall due to reduced incentives to provide them. And this, we might expect, would tend to diminish the wellbeing of those disabled persons who remain.¹³

Note, however, that there are other factors that may militate in the opposite direction. In the wheelchair access example above, two factors combined to make it plausible that a reduction in the number of wheelchairs would tend to reduce the level of public provision for wheelchair users. First, the economic cost of providing the facilities (in this case, ramps and accessible entrances) was relatively invariant to the number of wheelchair users. And second, the political, moral and economic incentives to provide the facilities were highly sensitive to the number of users.

In some cases, however, the reverse will obtain. For example, sometimes the amount that the government will be willing to spend on providing support for a given group will depend primarily on the amount of pressure they face from benevolently motivated people who do not have the disability, but believe those with the disability should receive state support. There is evidence to suggest that such benevolent motivations can be relatively invariant to the numbers of people who will be benefitted.¹⁴ Thus, if the political incentive to provide resources is driven largely by such benevolent motivations in the electorate, we might expect the incentive to be similarly invariant to the number of people that suffer from a disability. (If there were fewer people with Down's syndrome, the public at large might feel just as moved to provide state support for those with the syndrome.)

Additionally, there are many cases in which the costs of providing facilities to people with a disability are highly sensitive to the number of people to whom the facilities must be provided. Consider, for example, the costs of providing in-home nursing care. These will vary sharply with the number of people to whom the care must be provided. In cases where the incentive to provide for people with a disability is relatively fixed, and the costs of doing so are highly dependent on numbers, we might expect that decreasing the number of people with a disability will tend to *increase* the wellbeing of each disabled person. In effect, there will be more people competing for a share of the same pool of resources.

As a real-life example of this sort of effect, consider genetic screening for thalassemia among Greek Cypriots. Introduction of this practice reduced the absolute number of individuals living with thalassemia, however it did not reduce the resources made available to individuals with the condition. In fact, because the state kept funding levels the same and there was a smaller pool of patients to share the existing resources, each individual was made better off in resource terms.¹⁵

These thoughts suggest that the resources argument could cut both ways. Whether decreasing the number of people with a disability will, all things considered, reduce or increase the level of provision to those who remain is an empirical question, and will presumably vary from disability to disability. This suggests that, at most, the resources argument will justify restrictions on *some types of* disability screening.

Moreover, even where disability screening would, through effects on resource allocation, tend to reduce the wellbeing of those who remain with the disability, it is not clear that this will provide a sufficient justification for coercive state interference with the use of ESTs. This is because there may be alternative, less restrictive means of mitigating the problem. For example, because the harms to the disabled persons are, on the resources argument, *economic* in cause – they follow from a lack of economic resources – it seems quite possible that they could be *compensated* through economic means. Consider a system in which parents are permitted to select against deafness, but the state also takes steps to ensure that

there is no reduction in the quantity or quality of facilities provided to the deaf, if necessary, by diverting funds from elsewhere. It seems quite possible that such an approach could negate the resources argument even in the cases where, absent such compensation, disability screening would lead to reduced provision for existing disabled individuals.

3. Comparative and noncomparative future harms

The harm-based variant of the expressivist argument and the reduced resources argument are both most naturally understood as appealing to possible harms to currently existing people. The harms they appeal to are what McMahan calls *counterfactual comparative* harms – harms that consist in being made worse off than one would have been had the putatively harmful action not been performed.¹⁶ The thought is that disability screening makes existing disabled people worse off than they would have been in the absence of such screening.

Another way to respond to the liberal eugenic challenge would be to appeal to harms to future people. These harms might or might not be comparative in the sense described above.

Suppose that, shortly before I die, I bury poison near a school. This will remain undisturbed for 120 years but will then leach into drinking water. My actions will not harm any currently existing people, but will likely harm people who exist in 120 years and drink the contaminated water. Assuming that my act does not affect who exists in the future, it will cause harm in the standard, counterfactual comparative sense. Those who drink the water will be made worse off compared to the situation they would have been in had I not buried the poison.

It seems clear that the state may permissibly employ coercive interventions to prevent future counterfactual comparative harms of the sort described above, even if there is no risk to anyone one alive today. The mere fact that a harm will affect a future person, rather than someone alive today, neither takes it beyond the purview of the state nor diminishes its moral weight in such a way that coercive state interference could no longer be justified.

Future noncomparative harms differ from counterfactual comparative harms in that they do not make the victim of the harm worse off than she would otherwise have been. Indeed, noncomparative harms do not make the harm-victim worse off relative to any suitably defined comparator situation; they consist simply in being in a badly off state.

Thus, consider acts that increase the likelihood of a future environmental catastrophe, but also change who exists in the future. In this case the act arguably does not harm anyone in a counterfactual comparative sense.¹⁷ Provided those affected by the catastrophe nevertheless have lives worth living, they would not have been better off if the act that leads to the catastrophe had not been performed – they simply would not have existed. However the catastrophe would still be harmful in the noncomparative sense of causing people to exist in a badly off state.¹⁸

Acts which contribute to climate change provide a real life example of this type of harm. Some policies which aim to reduce the likelihood of dangerous climate change may also change which people exist in the future. For example, putting large tariffs on fuel prices may change travel patterns, affecting who meets whom, who conceives with whom, and when they conceive.¹⁹ In this case, implementing the policy may not make any individuals better off than they would otherwise have been. But as these policies are likely to prevent some types of environmental catastrophe, not implementing these policies will still result in noncomparative harms – it will cause people to be in badly off states.

Though this is more controversial, it is plausible that the state would be justified in imposing coercive restrictions to prevent future noncomparative harms. Many think the state should be able to impose restrictions to prevent climate change or nuclear disaster, even if the only harms that it would prevent are noncomparative.

Most acts which increase the likelihood of future catastrophes will result in a mix of counterfactual comparative and noncomparative harms. These acts are likely to affect the identities of some, but not all, of the people who will exist when the catastrophe occurs. These acts will bring about comparative harms to future people whose identity is independent of the act, and noncomparative harms to

people whose existence is dependent on the act.²⁰ However, even if such an act will bring about only noncomparative harms, it can, if those harms are of sufficient moral weight, permissibly be subjected to coercive state interference. At least, this is what we shall assume, in line with widely held and plausible views regarding the prevention of climate change and nuclear disaster. Hence one way to meet the liberal eugenic challenge may be to show that particular uses of reproductive technologies will make future generations more susceptible to future catastrophes.²¹

4. The Diversity Argument

We believe that the most promising argument for restrictions on disability screening appeals to precisely this sort of consideration – a risk of future catastrophes. The argument is a variant of an argument that has already played a prominent role in discussions of genetic selection,²² though it has not, to our knowledge, ever been developed in detail. That argument appeals to the view that use of ESTs could reduce valuable forms of human diversity; namely, the forms of human diversity that would be threatened by the elimination of disabilities. Proponents of this argument need not maintain that disability is all-things-considered, or even in any respect, good for the disabled individual. Their claim is that the presence of individuals with disability contributes to a property of the population – diversity – which is valuable either impersonally or for some or all of the members of the population.

Some proponents of this ‘diversity argument’ treat diversity as an intrinsic good. Parens states that:

*with respect to genetic technology, we can begin by saying that it goes too far when – in an attempt to establish paradise on earth – it threatensthe good that is the diversity of human forms.*²³

Unfortunately Parens does not elaborate as to why the diversity of human forms is a good. Further he does not specify which types of human diversity are good. It is not clear that all forms of human diversity are valuable. For instance, we might doubt whether diversity in lifespan among humans is in any way good.

Perhaps nothing of value would be lost if everyone lived as long as the currently longest-lived individuals.²⁴

Other forms of the diversity argument stress the instrumental, rather than the intrinsic, value of human diversity. McMahan introduces (though does not endorse), an argument according to which disability is important because it teaches individuals valuable lessons, and may enhance the development of positive character traits:

It is often held that a reduction in the number of disabled people would have an adverse effect on human diversity... the disabled themselves, and indeed their mere presence among the rest of us, teach valuable lessons about respect for difference, about the nobility of achievement in the face of grave obstacles, and even about the value of life and what makes a life worth living.²⁵

Rosemarie Garland-Thomson's recent argument that disability should be viewed as 'a potentially generative resource rather than unequivocally restrictive liability', also invokes some of the *instrumental* benefits of diversity.²⁶ Garland-Thomson argues that the presence of people with disability in our communities provides us with important cultural narratives, produces distinctive ways of knowing, and teaches us important ethical lessons. On her view, we should view disability as an important resource, and one that ought to be conserved.²⁷

We will not develop these versions of the diversity argument further. Rather we will develop a new variant of the diversity argument – one that also stresses the instrumental benefits of diversity. We argue that certain kinds of diversity are likely to protect future human populations from catastrophes caused by external threats (such as those posed by environmental disasters), and internal threats (such as nuclear war, or other failures of cooperation). Loss of these forms of diversity would leave human populations more susceptible to future catastrophes and would thus increase the risk of severe comparative or noncomparative harms to future people.

Why think that losses in diversity might increase the risk of future catastrophes? The loss of resilience to threats associated with losses of *genetic* diversity in other species of animals serves as a good illustration of the costs of reducing some

types of population diversity. A number of studies with other species indicate that even moderate losses in genetic diversity can result in catastrophic outcomes for future members of the population.²⁸ Reducing genetic diversity makes populations less robust and resilient to a range of possible catastrophic threats including climate change, pathogens, predators, and changes in resource availability.²⁹ Although genetic diversity is not as important for humans as it is for other species of animals,³⁰ other types of human diversity may be important for protecting against catastrophes. For example recent work in social science has stressed the group-wide benefits associated with cognitive diversity, that is, diversity in how each 'individual sees the world, interprets its problems, and makes predictions in it'.³¹ Research suggests that when group members are able to effectively cooperate with each other, cognitively diverse groups are more productive, more innovative and better at solving complex problems than less diverse groups.³² Cognitive diversity enables groups to better search epistemic space and find optimal solutions to problems. A meta-analysis of the influence of diversity on team performance in the workplace showed that diversity in cognitive skills is associated with improved problem solving ability and increased innovation.³³

Cognitive diversity also helps groups make accurate predictions. The 'wisdom of crowds' describes a phenomenon in which the median estimate of a group is more accurate than estimates of experts. This was first observed for relatively mundane predictions, such as guessing the weight of oxen.³⁴ However crowd-based predictions have since been shown to be more accurate than expert predictions in a diverse range of fields, including politics, sport, and economics.³⁵ Recently a project funded by the Office of the Director of National Intelligence found that crowd-based predictions were approximately 30% more accurate in predicting global events than foreign policy experts.³⁶ One of the key elements required for accurate crowd-based predictions is cognitive diversity. In general the more diverse a group is, the more accurate its predictions.³⁷

Reducing cognitive diversity could potentially harm future generations, as it could diminish society's ability to predict and deal with complex global problems like climate change and energy security. Cognitively diverse groups have greater cognitive resources available to predict and prevent future catastrophes. Other

things being equal, we might thus expect the members of more cognitively diverse groups to be better off than the members of less cognitively diverse groups.

If certain forms of human diversity are important to our ability to avert catastrophes, then an important question regarding disability screening is whether a specific disability contributes to these valuable forms of human diversity. In the following paragraphs we will argue that there is good evidence that at least two conditions which are often classed as disabilities (Asperger's syndrome and dyslexia) plausibly contribute to forms of diversity that are important for preventing catastrophes. We will suggest that this creates a *pro tanto* case for coercive restrictions on the use of ESTs to select against these disabilities.

4. 1 Asperger's syndrome

High functioning autism or Asperger's syndrome³⁸ is a form of autism that involves abnormalities in the development of social and communication skills, in the presence of marked repetitive behaviour and limited imagination, and in the absence of cognitive delay.³⁹ These abnormalities are associated with differences in the brains of children with Asperger's syndrome when compared to controls. In children with Asperger's syndrome some regions of the brain, particularly those that deal with language, show weaker connections between neurons when compared to other children,⁴⁰ while other regions of the brain are much more densely connected than in children without the syndrome.⁴¹ These differences in brain wiring may underpin some abilities that have been noted in individuals with Asperger's syndrome.

When solving problems, high functioning autistic individuals use different heuristics than controls, and are less prone to certain cognitive biases.⁴² This enables them to perform well on some tests which measure intelligence. Specifically individuals with Asperger's syndrome tend to perform well on tasks which require close attention to the specific details of a problem such as the *Block Design Test*, which requires subjects to manipulate a group of blocks to match various two-dimensional patterns, and the *Embedded Figures Test*, which involves locating specific shapes or patterns within a larger, more complex design.

Individuals with Asperger's syndrome are also more likely than others to have perfect pitch musically and to be able to pick out or 'disembed' individual notes from complex chords in a musical score.⁴³

Another characteristic of children with Asperger's syndrome is their tendency to have intense personal interests. In one study of children with Asperger's syndrome, 90% were seen to have obsessive interests in such diverse subjects as deep-fat fryers, the passenger list of the Titanic, waist measurements, Great Western trains, Rommel's desert wars, paper bags, light and darkness, globes and maps, elevators, and shoes.⁴⁴

The combination of these unique cognitive abilities with intense personal interests can enable individuals with Asperger's syndrome to make valuable contributions in numerous fields of endeavour, most notably scientific fields. It has been hypothesised that some of history's greatest scientists had Asperger's syndrome. Isaac Newton, Albert Einstein and Henry Cavendish all exhibited an unusually intense interest in their fields coupled with a lack of interest in communicating with others. Simon Baron-Cohen, the psychiatrist who heads the autism research centre at Cambridge, believes all three likely had Asperger's syndrome.⁴⁵ Studies of university math and science students at Cambridge University, and of Math-Olympiad winners, have shown that individuals with Asperger's syndrome are over represented in these groups and support earlier studies suggesting that Asperger's syndrome is associated with scientific skills.⁴⁶

Interestingly, the potential for individuals with Asperger's syndrome to make important contributions to various fields was noted by Hans Asperger, the physician who first described the condition in 1944:

*A good professional attitude involves single-mindedness as well as a decision to give up a large number of other interests. Many people find this a very unpleasant decision. Quite a number of young people choose the wrong job because, being equally talented in different areas, they cannot muster the dedication to focus on a single career. With the autistic individual the matter is entirely different. With collected energy and obvious confidence and, yes, with a blinkered attitude towards life's rich rewards, they go their own way, the way in which their talents have directed them since childhood.*⁴⁷

Given these features of Asperger's syndrome, it seems plausible that individuals with Asperger's syndrome contribute to a valuable form of cognitive diversity. They have a particular way of looking at the world which gives them a unique perspective on problems and encourages them to develop different (and often highly effective) problem-solving heuristics.⁴⁸ The diversity produced by the presence of individuals with Asperger's syndrome might thus be expected to improve society's collective ability to solve complex problems and thus to avert catastrophes in the face of external and internal threats.

Of course, the problem-solving ability conferred on a population by the presence of individuals with Asperger's syndrome and the technological developments that it enables may not always be put to beneficial uses and may indeed sometimes create catastrophic threats. For example, some would argue that progress in certain scientific fields, such as nuclear physics and synthetic virology, creates more catastrophic threats than it mitigates. However, it seems reasonable to suppose that greater problem-solving abilities generally conduce to human wellbeing, and certainly this is an assumption widely made in relation to education systems, which seek in part to develop such abilities.

4.2 Dyslexia

Dyslexia is a developmental disorder associated with difficulties in some combination of reading, writing, spelling, handwriting, speaking, listening and memory.⁴⁹ These difficulties are associated with differences in the way individuals with dyslexia process information. The brains of dyslexics are characterised by 'local hypoconnectivity and long-range hyperconnectivity', when compared to controls.⁵⁰ This means there are fewer connections within particular regions of the brain, including the auditory and speech centres, but more connections between disparate regions of the brain. This may explain why dyslexics have problems with processing fine details, but also why they have unusual abilities in certain domains. In particular dyslexics have been identified as having strength in forming 'big picture connections'.⁵¹

Studies have demonstrated that dyslexic individuals perform better on tasks requiring innovative solutions than non-dyslexics.⁵² Dyslexia has also been associated with improved performance in certain tests of visual-spatial ability.⁵³

These abilities may explain why dyslexics appear to thrive in fields which require creative thought. For example, in business, dyslexics are over-represented among entrepreneurs while underrepresented in corporate managers.⁵⁴ Dyslexics also tend to be over-represented at art schools. A study at the Central St Martin's College of Art and Design found that approximately 75% of foundation-year students had a form of dyslexia. The author concludes:

- *My research so far seems to show that there does seem to be a 'trade-off' between being able to see the world in this wonderfully vivid and three-dimensional way, and an inability to cope with the written word either through reading or writing.*⁵⁵

It seems plausible to suppose that the presence of dyslexic individuals contributes to a valuable form of human diversity. As we have seen, there is evidence that diversity in thinking styles and approaches contribute to a group's ability to solve problems. Not only does the presence of dyslexic individuals in a population plausibly contribute to such diversity, it does so in a way that might seem particularly conducive to problem solving: it is not difficult to see how creativity and the ability to see big-picture connections – two of the cognitive abilities characteristic of dyslexia – might be particularly helpful in identifying potential solutions to a problem. There is thus some reason to believe, for reasons similar to those that applied to Asperger's syndrome, that a human population that contains some individuals with dyslexia will be more effective in preventing catastrophes than a population without dyslexic individuals.

4.3 Summary- disability, cognitive diversity and future catastrophes

As outlined in Section 4, evidence suggests that cognitive diversity improves the ability of groups to solve problems and make accurate predictions. Reducing such diversity may therefore impede the ability of future generations to predict and respond to future catastrophes. Dyslexia and Asperger's syndrome are just two examples of conditions which would be classed as disabilities, but which may contribute significantly to diversity of the kind that has been shown to conduce to problem solving. Indeed, the skills that are characteristic of these

conditions may be especially conducive to good problem solving, at a population level.

Some other conditions which are classed as cognitive disabilities or mental disorders – such as attention deficit hyperactivity disorder (ADHD) and depression – arguably also contribute to valuable forms cognitive diversity, for similar reasons to those outlined above. In addition, it might be argued that some physical disabilities, such as deafness, indirectly lead individuals to develop a range of unique perspectives and heuristics.⁵⁶ It is thus possible that the presence of some deaf individuals in the human population helps to increase our population's problem-solving ability and thus resilience to catastrophic threats.

In this paper, we take no firm stand on whether any particular disability contributes to valuable forms of human diversity, and to a degree sufficient to warrant coercive state restrictions on selection against them. However, we suggest that it is somewhat plausible that Asperger's syndrome and dyslexia do so. We believe an important question when assessing the ethics of screening against a particular disability is whether it contributes to the development of unique and valuable perspectives and heuristics. This is an empirical question, and we believe there is important work to be done in this area. Psychological studies have shown that people suffering from depression and Asperger's syndrome use different problem solving heuristics than others and as a result do better on specific tasks.⁵⁷ However there appears to be little work establishing whether this is also true of other disabilities.

Furthermore, little work has been done to quantify the benefits of cognitive diversity on population problem-solving ability. For example, do teams with dyslexics outperform teams without dyslexics on problem solving tasks? Do corporations with individuals with Asperger's syndrome outperform other comparable corporations? Such studies may help us determine the degree to which the diversity provided by these cognitive types is instrumentally valuable, and consequently the moral weight of the reasons to conserve it.

5- Implications

Suppose it could be shown that some disabilities contribute to cognitive diversity that itself contributes to the ability of future generations to avert catastrophes. And suppose also that, in the absence of coercive state interference, parental choices regarding the application of disability screening could be expected to undermine this diversity.⁵⁸ What would follow? We suggest that there would then be a *pro tanto*, liberal-friendly case for coercive state interference on disability screening against the disability in question. By '*pro tanto*' we mean that the case has some normative force, though it might be defeated by countervailing considerations. By 'liberal friendly', we mean that the case is capable of meeting the liberal eugenic challenge. (Whether it in fact meets the challenge will depend, we think, on *how far* the coercive interference could be expected to reduce risks of catastrophe.)

The basis for this suggestion is clear: as noted above, risks of future catastrophes are widely and plausibly regarded, even by liberals, as capable of justifying coercive measures. Comparative and noncomparative harms to future persons of the sort involved in catastrophes seem to fall within the purview of the state in the sense that they generate reasons for the state to mitigate those risks through coercive means. Moreover, those reasons seem sometimes to be decisive; while it is difficult to determine the likelihood and severity of future catastrophes, they are sometimes seen as sufficiently probable and severe to warrant coercive state interference.

There is, however, an important objection that might be made to our suggestion; it might be argued that it is either uninteresting or it has implausible implications for disability *treatments*. Our suggestion was that, in certain cases, there is a *pro tanto* case for coercive restrictions on disability screening. But as we noted, a *pro tanto* case may not be decisive. It may be defeated by countervailing considerations. It might be thought that our suggestion will be interesting only if there are some actual disabilities in relation to which the case for coercive restrictions is *not* defeated, so that coercive restrictions are justified, all things considered. But if this is so, then our suggestion might seem to imply that we should also introduce coercive restrictions on access to *treatments* for the disabilities in question.

To see why our argument may have this implication, note that it is conceivable that in the future other treatments will be developed that could lower the frequencies of the sorts of disabilities we have mentioned. For example, a dietary supplement may be developed that, if taken by women while pregnant, would prevent the resulting child from developing dyslexia. Similarly, we might imagine that an empathy enhancing educational programme will be developed for toddlers and that this would cause their brains to develop in such a way as to prevent the development of Asperger's syndrome. Both of these treatments, if widely used, would reduce the same kinds of cognitive diversity as would screening against embryos predisposed to these conditions. It might therefore be argued that, if coercive restrictions on disability screening are sometimes justified in the name of preserving diversity, then similar restrictions on treatments like these would also be justified. But this conclusion may be considered unacceptable.

We do not believe our suggestion has this implication, however. There is an important difference between the disability screening technologies we discuss, and disability treatments. If the state were to prevent the pregnant woman from taking the dietary supplements, or the parents of children with Asperger's syndrome from accessing the educational programme, the state would be making these children worse off than they would otherwise have been.⁵⁹ Dyslexia and Asperger's syndrome are both disabilities which make life harder for people who suffer from them. Dyslexics perform worse at school than non-dyslexics, which can have long term implications for employment prospects. People suffering from Asperger's syndrome often have trouble finding full time employment.⁶⁰ In the above example, if the prenatal child was not given the dietary supplement, or if the toddler was denied access to the educational program, their lives would arguably contain less wellbeing as a result. Therefore if the state were to block access to these treatments, it would be making those children worse off than they otherwise would have been. It would result in counterfactual comparative harms, in the sense outlined in Section 3. This is not the case when parents are prevented from accessing disability screening technologies. If parents are prevented from accessing disability screening services, this may result in the parents having a disabled child when they otherwise would have had a child

without a disability, but, except if the disability is so severe as to make life not worth living, the disabled child will arguably not have been made worse off than would otherwise have been case, for he or she would not otherwise have existed.⁶¹ Indeed, the only harms involved in such cases are *noncomparative*.

It seems plausible that this is a relevant consideration in deciding whether the state can justifiably prevent individuals from accessing a particular service. For it is plausible to think that reasons not to reduce a given individual's wellbeing are, other things being equal, stronger than reasons not to have a less well-off child in place of a better-off child.⁶² That is, that we should sometimes give more weight to counterfactual comparative harms than noncomparative harms.

Thus, though we believe that the *pro tanto* case for restricting access to disability treatments in the name of preserving cognitive diversity will be as strong as the case for restricting access to screening services in respect of the same disability, the case *against* may well be stronger in relation to treatments than in relation to screening technologies. So even if coercive state interference in disability screening is sometimes justified (because the *pro tanto* case that we have invoked is decisive) it may be that comparable restrictions on disability *treatments* would never be justified because the case against them is always decisive.

This brings us to the question of whether coercive state interference in disability screening is indeed sometimes justified – whether the *pro tanto* case we have proposed is sometimes decisive. This will, of course, depend on the normative force and breadth of scope of countervailing considerations – considerations that militate against restrictions on disability screening. At least three such considerations warrant mentioning.

The first of these is the non-comparative harm caused by the disability. The specific disabilities we mention, dyslexia and Asperger's syndrome, are mild cognitive disabilities. Imagine, for whatever reason, that the presence of people with Angelman syndrome (a neuro-genetic disorder characterized by severe intellectual and developmental disability and seizures) would help avert future catastrophes. The selection of embryos predisposed to Angelman syndrome would not result in any comparative harms, assuming that those with the syndrome still have lives worth living, and in this sense is similar to the selection

of embryos predisposed to dyslexia. However Angelman syndrome results in greater non-comparative harms than dyslexia, as it causes intrinsically worse states. As reasons to prevent noncomparative harms have weight, there are greater reasons not to limit access to disability screening services which select against Angelman syndrome, than those which select against dyslexia. Broadly, this means there are stronger reasons against the selection of embryos predisposed to severe disabilities than the selection of embryos predisposed to moderate and mild disabilities. This may count decisively against 'genetic scapegoat', type scenarios, in which people with very severe disabilities are selected in order to benefit the majority.⁶³

The second countervailing considerations is the possibility that restricting disability screening in order to prevent future catastrophes would exploit those children who will, as a result of the restriction, be born with disabilities. It would use those children in order to prevent future catastrophes. McMahan suggests this as a criticism for any arguments appealing to the benefits of the existence of disabled persons for others. He states:

*I do not know of anyone who has argued that it would be desirable for at least some people to cause themselves to have disabled rather than normal children on the ground that this would ensure a healthy degree of diversity and enable more people to benefit from enlightening contacts with the disabled. For that would seem exploitative; it would treat the disabled as a means of benefiting others.*⁶⁴

We do not deny that there is some sense in which causing the existence of people with certain disabilities in part because of the social benefits associated with these conditions, may be exploitative. If this is so, reasons not to exploit future children will need to be weighed against reasons to prevent the population-level harms that we have been discussing. However, we do note that in the specific cases we argue for, those at risk of exploitation (i.e. individuals who are born with dyslexia or Asperger's syndrome) are not harmed in a counterfactual comparative sense, and suffer only minor or moderate non-comparative harms. The reasons against exploitation of this type may carry less weight than reasons against exploitation where the exploited party is badly harmed in order to benefit others.

A third countervailing consideration is effects on third parties. The most immediate third parties who are affected by restrictions on disability screening services are parents who would access such services. Reducing access to disability screening limits the number of reproductive options available to parents and thereby reduces their procreative autonomy. Further, limiting access to disability screening services can impose further burdens on parents. Raising disabled children can be much more difficult than raising children without disabilities, even for relatively mild disabilities like dyslexia and Asperger's syndrome. Of course, it may also be more rewarding in some respects, so it does not necessarily follow that the parents of disabled children are generally worse off than the parents of other children and non-parents. But suppose that, at least for certain disabilities, they are. Hence, if the state were to prevent parents from screening against those disabilities, this would tend to make some prospective parents worse off than they would otherwise have been. This creates a *pro tanto* case against restrictions on freedom that needs to be balanced against the *pro tanto* case in favour that we have proposed.

Whether and when concerns about non-comparative harms, exploitation, effects on third parties, and any other countervailing considerations are sufficiently forceful and broad in scope that they would *always* outweigh the *pro tanto* case that we have identified in favour of restrictions of disability screening is not something we can determine here. However, we suggest that it is not *obvious* in advance of further examination that they would do so, particularly given that (i) it might be possible to adopt policies that restrict disability screening in most circumstances, while somewhat limiting the costs for parents (for example, by permitting access to disability screening for parents who already have a disabled child or are otherwise liable to find caring for such a child particularly burdensome), and (ii) in other areas of reproductive decision-making it is often regarded to be permissible for parents to treat their future children partly as means to benefit others (for example, few would hold it to be impermissible for parents to have a child in part to bring greater joy to their own lives or to provide a companion for an existing child).⁶⁵ Thus, we believe that it remains a live possibility that the *pro tanto* case we have proposed will sometimes provide decisive support to the introduction of restrictions.

At this point it might be objected that, if our argument does indeed imply the permissibility of restrictions on some forms of disability screening, it will also imply the permissibility of requiring parents *to* engage in certain forms of genetic selection. For example, it may imply that the state could permissibly require prospective parents to select *for* Asperger's syndrome or dyslexia. Similarly, it might require parents to select *for* certain socially beneficial non-disease-related traits, such as a disposition towards altruism, were this possible. These implications may seem unpalatable.

There are at least two grounds on which we might try to resist such implications. First, we might argue that, though there is indeed a *pro tanto* reason to require parents to engage in certain forms of genetic selection, there are stronger reasons against doing so than there are in the case of *prohibiting* certain forms of genetic selection. This proposition is supported by some of the countervailing considerations discussed above. For example, it might plausibly be thought that requiring parents *to* engage in genetic selection involves a more serious infringement of procreative autonomy than requiring parents not to engage in genetic selection. A requirement for parents to engage in genetic selection entails a further requirement to reproduce through IVF. This may be thought to be a particularly stringent requirement, and incompatible with a basic level of procreative freedom. Requiring parents not to engage in genetic sexual involves no such limitations on normal sexual reproduction, and is therefore compatible with greater levels of procreative freedom. This may give the state stronger reasons not to require genetic selection than not to prohibit it.

Second, we might argue that the reasons to require selection for disability are somewhat weaker than the reasons to prohibit selection against it. This proposition might be supported by an appeal to a distinction between doing and allowing harm. In requiring parents to select for socially beneficial disabilities or other traits, the state would be preventing prospective parents from, through abstaining from genetic selection, allowing harm to befall future persons. By contrast, in the cases of interest to us — prohibiting selection against certain socially beneficial disabilities or traits — the state would arguably be preventing prospective parents from *doing* harm to future persons through engaging in genetic selection. It is plausible that the *pro tanto* reason to prevent prospective

parents from allowing harm is weaker than the *pro tanto* reason to prevent parents from doing harm. Thus, not only may there be stronger reasons against selection-requiring programmes than selection-prohibiting programmes, there may also be weaker reasons in favour.

Whether these replies are forceful enough to establish that requiring genetic selection would *never* be justified is a difficult question that we cannot pursue here. Thus, for the moment we must concede that there may indeed be some cases in which such a requirement would, counter-intuitively, be justified.

Conclusion

In this paper we have examined whether and why the state could justifiably place restrictions on the use of disability screening technologies. The challenge posed by liberal eugenics is for people who think parents' access to these technologies should be restricted to show how their use would result in harms that would justify coercive state interference. We have argued that the criticisms most commonly advanced against disability screening fail to meet this challenge as they do not point to harms of the right kind and magnitude. We then developed a form of the diversity argument stressing the instrumental benefits associated with some disabilities. As some disabilities result in unique perspectives and heuristics, they may contribute forms of cognitive diversity which will augment the ability of future generations to avert catastrophes. This, we suggested, creates a *pro tanto* case for restrictions on access to disability screening technologies in relation to the disabilities in question. We suggested further that this case may well be sufficient to justify restrictions in some cases; at least, this seems a live possibility.

If we are correct, we believe our arguments may go some way to vindicating widely held intuitions about which disabilities should, and which should not, be subject to state restrictions. Some people have the intuition that parents should be permitted to screen against serious disabilities, but not against mild disabilities. Indeed a distinction between serious and non-serious conditions is written into the legislation in certain countries.⁶⁶ However this position is difficult to defend at a theoretical level. While many bioethicists draw a theoretical distinction between therapeutic and enhancing uses of reproductive

technologies, this does not explain why parents should be allowed to select against serious disabilities, but not others. Preventing any disease or disability is therapeutic even if those conditions are not serious. Hence this view cannot underlie the intuitive position that parents should be allowed to select against serious condition, but not mild disabilities.

In our model, certain disabilities contribute to valuable types of diversity which benefit society in important ways. The core of our argument is that there are some disabilities which may prevent harm to those in future generations when they occur in small proportions. This is likely to justify restrictions on selection against some less severe disabilities such as Asperger's syndrome and dyslexia, but not restrictions on selection against more serious conditions such as Down's Syndrome or Tay Sachs. Therefore we believe that the view presented in this paper may help ground an intuitive distinction between selection against severe and selection against mild conditions. Note, however, that our view will not explain why parents should be prevented from selecting against mild disability in cases where the mild disability would not contribute to any valuable form of diversity.

We would like to end with two clarifications.

First, we acknowledge that our argument may seem insensitive or callous to the extent that it sets aside the interests of those currently existing people who most obviously have something to lose from disability screening: individuals with the disabilities that might be the objects of such screening. We would thus like to clarify that, though our argument does not invoke the interests of current people with disabilities, we believe these interests are certainly relevant to the moral status of disability screening. We set these interests aside in this paper partly because we believe, for the reasons outlined in Section 2, that an appeal to such interests is unlikely to meet the liberal eugenic challenge, and thus unlikely to justify coercive state interference.

Second, we have focussed in this article on the use of ESTs to select against disabilities – the application in which the case for ESTs has been thought the strongest. However, the arguments we have presented also have implications for the use of ESTs to select against non-disease traits that parents may regard as

undesirable. Suppose it become possible to target certain cognitive traits, such as degree of extroversion, and that many parents were choosing to select embryos with similar cognitive traits – say, a high degree of extroversion. This could diminish cognitive diversity in a way that would place future populations more at risk of future catastrophes and, if our arguments hold, this would create a *pro tanto* case for coercive state interference in the pro-extroversion use of ESTs. More generally, there is no reason to suppose that selecting against non-disease traits will be immune to the types of concerns that we have raised in this article.⁶⁷

NOTES

¹ Following the World Health Organization, we understand disability as an umbrella term covering ‘impairments, activity limitations, and participation restrictions’. An *impairment* is a problem in body function or structure; an *activity limitation* is a difficulty encountered by an individual in executing a task or action; while a *participation restriction* is a problem experienced by an individual in involvement in life situations. Thus, disability is a complex phenomenon, reflecting an interaction between features of a person’s body and features of the society in which he or she lives. World Health Organisation, *World Report on Disability* (Geneva: WHO Press, 2011), p. 7.

² R. Sparrow, ‘Better Than Men?: Sex and the Therapy/Enhancement Distinction’, *Kennedy Institute of Ethics Journal*, 20, (2010): 115-44

³ M. Sandel, ‘The Case against Perfection’, *The Atlantic*, April (2004): 1-11.

⁴ The argument that we develop in this paper can be seen as building on those offered in Jakob Elster, ‘Procreative Beneficence - Cui Bono?’, *Bioethics*, 25, 9 (2011): 482-8; and Thomas Douglas and Katrien Devolder, ‘Procreative Altruism: Beyond Individualism in Reproductive Selection’, *Journal of Medicine and Philosophy*, 38, 4 (2013): 400-19. Those articles argue that effects of genetic selection decisions on third parties (*viz.* individuals besides the selected child and prospective parents) bear on the moral permissibility of the genetic selection. Here, we argue that certain effects on third parties might also bear on the permissibility of coercive state interference in genetic selection.

⁵ For an overview of this approach, see N. Agar, *Liberal Eugenics: In Defence of Human Enhancement* (Oxford: Blackwell, 2004). Also see J.A Robertson, ‘Procreative Liberty in the Era of Genomics’, *American Journal of Law & Medicine*, 29 (2003): 439-87.

⁶ R. Nozick, *Anarchy, State, and Utopia* (New York: Basic Books, 1974), p. 315.

⁷ See, most famously, Mill’s harm principle – J. Riley, *Mill On Liberty*, (London: Routledge, 1998), pp 91-110.

⁸ There is no clear consensus among liberals about when causing harm to others renders permissible coercive state interference. Some believe governments are morally permitted to interfere with individual liberty only to protect ‘the physical integrity of individuals’ [Dyzenhaus, ‘John Stuart Mill and the Harm of Pornography’, *Ethics*, 102 (1992): 534 -551]. Nozick (1974, *op. cit.*) holds that only harms which violate the rights of others can justify restrictions on individual’s liberty. Other scholars advocate a view according to which any act that harms others may warrant coercive state interference provided the harm is of sufficient magnitude [N. Turner, ‘“Harm” and Mill’s Harm Principle’, *Ethics* 124 (2014), 299-326]. As far as possible we remain neutral on this issue in this paper, noting only that most liberals agree that the mere presence of harm to others is not sufficient to warrant coercive state interference.

⁹ See for example: A. Davis, 'Women with Disabilities: Abortion and Liberation', *Disability, Handicap & Society*, 2 (1987): 275-84; A. Asch, 'Reproductive Technology and Disability' In S. Cohen and N. Taub (eds.) *Reproductive Laws for the 1990s* (Clifton N.J.: Humana Press, 1988), pp. 69-124; A. Lippman, 'The Genetic Construction of Prenatal Testing: Choice, Consent, or Conformity for Women?' in K. Rothenberg and E. Thomson (eds.) *Women and Prenatal Testing: Facing the Challenges of Genetic Technology* (Columbus: Ohio State Press, 1994); S. Wendell, *The Rejected Body: Feminist Philosophical Reflections on Disability* (Routledge, 1996); E. Parens, and Asch, A, 'The Disability Rights Critique of Prenatal Genetic Testing: Reflections and Recommendations' *The Hastings Centre Report* 29 (1999): 1-22. A. Asch and D. Wasserman, 'Where is the Sin in Synecdoche? Prenatal Testing and the Parent-Child Relationship' in D. Wasserman, J. Bickenbach and R. Wachbroit (eds.) *Quality of Life and Human Difference: Genetic Testing, Health Care, and Disability* (New York, NY: Cambridge University Press, 2005) pp. 172-216.

¹⁰ Parens and Asch (1999), op. cit. For criticisms of this argument, see J. Nelson, 'The Meaning of the Act: Reflections on the Expressive Force of Reproductive Decision Making and Policies', In Parens and Asch (eds.) *Prenatal Testing and Disability Rights* (Washington: Georgetown University Press, 2000) pp 196-213; J. McMahan, 'Causing Disabled People to Exist and Causing People to Be Disabled', *Ethics*, 116 (2005): 77-99; J. Glover, *Choosing Children: Genes, Disability, and Design* (Oxford: Oxford Clarendon Press, 2006); J. Harris, *Enhancing Evolution : The Ethical Case for Making Better People* (Princeton, NJ: Princeton University Press, 2007). Note that an appeal to the excessive willingness to infer global judgments from a single fact could also figure in harm-based versions of the expressivist argument, which we discuss below.

¹¹ Note that there are other possible explanations for the objectionability of expressing the judgment that a disabled child is in some ways worse or less worthy of existence than a non-disabled child. For example, it might be objectionable to express the judgment simply because the judgment is false, not grounded on adequate evidence, or because doing so is disrespectful.

¹² T. Shakespeare, *Disability Rights and Wrongs Revisited* (Taylor & Francis, 2013) pp 127-129.

¹³ See, for a statement of this argument, L. Gillam, 'Prenatal Diagnosis and Discrimination against the Disabled', *Journal of Medical Ethics*, 25 (1999): 163-71

¹⁴ See, for example, D. A. Small et al., 'Sympathy and Callousness: The Impact of Deliberative Thought on Donations to Identifiable and Statistical Victims', *Organizational Behavior and Human Decision Processes*, 102 (2007): 143-153.

¹⁵ P. Kitcher, *The Lives to Come* (Free Press, 1997), pp 85-86.

¹⁶ Counterfactual comparative harms should be distinguished from temporal comparative harms, where the harm consists in being made worse off than one was *before* the harmdoer acted. See Jeff McMahan, 'Causing People to Exist and Saving People's Lives', *Journal of Ethics* 17 (201 3): 5-35; M. Hanser, 'The Metaphysics of Harm', *Philosophy and Phenomenological Research*, 77 (2008): 421-450.

¹⁷ This is a version of Parfit's 'risky policy' case. See D. Parfit, *Reasons and Persons*, (Oxford: Oxford University Press, 1984).

¹⁸ See McMahan (2013), op. cit.

¹⁹ See J. Broome, *Counting the Cost of Global Warming* (Cambridge: The White Horse Press, 1992), pp 33-34.

²⁰ It should be noted that bringing about a future catastrophe could also cause counterfactual comparative harms to currently existing people, if the catastrophe occurs within their lifetimes.

²¹ In this paper we will assume the likelihood of some future catastrophes is high enough that actions which diminish our ability to mitigate them will warrant coercive state interference.

- ²² See for example E. Parens, 'The Goodness of Fragility: On the Prospect of Genetic Technologies Aimed at the Enhancement of Human Capacities', *Kennedy Institute of Ethics Journal*, 5 (1995): 141-53; P. Singer, 'Shopping at the Genetic Supermarket' In S. Y. Song, Y. M. Khoo, & R. J. Macer (eds.) *Asian Bioethics in the 21st Century* (Christchurch, New Zealand: Eubios Ethics Institute, 2003) pp. 143 – 156; J. McMahan, 'The Morality of Screening for Disability', *Reproductive BioMedicine Online*, 10 (2005): 129-32; R. Sparrow, 'Fear of a Female Planet: How John Harris came to Endorse Eugenic Social Engineering', *Journal of Medical Ethics*, 38 (2011): 4-7; R. Powell, 'The Evolutionary Biological Implications of Human Genetic Engineering', *Journal of Medicine and Philosophy*, 37 (2012): 204-225; R. Garland-Thomson, 'The Case for Conserving Disability', *Journal of Bioethical Inquiry*, 9 (2012): 339-355.
- ²³ E. Parens (1995), op.cit.
- ²⁴ Powell (2012), op.cit.
- ²⁵ McMahan (2005), op.cit.
- ²⁶ Garland-Thomson (2012), op.cit.
- ²⁷ For a critique of Garland-Thomson's view, see R. Sparrow, 'Imposing Genetic Diversity', *American Journal of Bioethics*, 15 (6) (2015) 2-10.
- ²⁸ J. A. Markert, et al., 'Population Genetic Diversity and Fitness in Multiple Environments', *BMC Evolutionary Biology*, 10 (2010): 205.
- ²⁹ R. Frankham, 'Genetics and Extinction', *Biological Conservation*, 126 (2005): 131-140
- ³⁰ Powell (2012), op.cit.
- ³¹ H. Landemore, 'Deliberation, Cognitive Diversity, and Democratic Inclusiveness: An Epistemic Argument for the Random Selection of Representatives', *Synthese*, 190 (2012): 1209-1231.
- ³² See L. Hong & S. E. Page, 'Groups of Diverse Problem Solvers Can Outperform Groups of High-Ability Problem Solvers', *Proceedings of the National Academy of Sciences of the United States of America*, 101 (2004): 16385-16389; S. E. Page, *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies*, (Princeton: Princeton University Press, 2007).
- ³³ S. K. Horwitz and I. B. Horwitz, 'The Effects of Team Diversity on Team Outcomes: A Meta-analytic Review of Team Demography', *Journal of Management*, 33 (6): 987-1015.
- ³⁴ F. Galton, 'Vox populi', *Nature*, 75 (1907): 450-451.
- ³⁵ Page (2007), op.cit. p 321-324.
- ³⁶ A. Spiegel (2014), 'So You Think You're Smarter Than A CIA Agent', *NPR.org*. On-line, available at < www.npr.org/sections/parallels/2014/04/02/297839429/-so-you-think-youre-smarter-than-a-cia-agent > [Accessed 27 January 2016]
- ³⁷ Page (2007), op.cit. p 205.
- ³⁸ Asperger's syndrome and high functioning autism are sometimes treated as different conditions in the literature. However for the purpose of this section we will treat Asperger's syndrome and high functioning autism together. This is because there is evidence to suggest that the underlying genetic basis of the conditions is linked, hence they would have to be selected for or against together. See: B. Chakrabarti et al., 'Genes Related to Sex Steroids, Neural Growth, and Social-Emotional Behavior Are Associated with Autistic Traits, Empathy, and Asperger Syndrome', *Autism Research*, 2 (2009): 157-77
- ³⁹ S. Baron-Cohen et al., 'The Autism-Spectrum Quotient (Aq): Evidence from Asperger Syndrome/High-Functioning Autism, Males and Females, Scientists and Mathematicians', *Journal of Autism and Developmental Disorders*, 31 (2001): 5-17
- ⁴⁰ F. H. Duffy et al., 'The Relationship of Asperger's Syndrome to Autism: A Preliminary EEG Coherence Study', *BMC Medicine*, 11 (2013): 175
- ⁴¹ K. Supekar, et al. 'Hyperconnectivity in Children with Autism and Its Links to Social Deficits', *Cell Reports*, 5 (2013): 738-747.

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- ⁴² K Morsanyi et al., 'Heuristics and Biases in Autism: Less Biased But Not More Logical', in N. A. Taatgen and H. van Rijn (eds), *Proceedings of the 31st Annual Conference of the Cognitive Science Society* (Austin, Texas: Cognitive Science Society, 2009) pp. 75-80.
- ⁴³ T. Armstrong, *Neurodiversity: Discovering the Extraordinary Gifts of Autism, Adhd, Dyslexia, and Other Brain Differences* (Da Capo Press, 2013), pp 61-62.
- ⁴⁴ Armstrong (2013), op. cit.
- ⁴⁵ I. James 'Singular scientists', *Journal of the Royal Society of Medicine*, 96 (2003): 36-39
- ⁴⁶ S. Baron-Cohen et al (2001), op. cit.
- ⁴⁷ James (2003), op. cit.
- ⁴⁸ Morsanyi, et al. (2009), op. cit.
- ⁴⁹ T. Armstrong (2013), op. cit.
- ⁵⁰ E. L. Williams and M. F. Casanova, 'Autism and Dyslexia: A Spectrum of Cognitive Styles as Defined by Minicolumnar Morphometry', *Medical Hypotheses*, 74 (2010): 59-62.
- ⁵¹ B. Eide, *The Dyslexic Advantage: Unlocking the Hidden Potential of the Dyslexic Brain* (Hay House, Incorporated, 2011).
- ⁵² J. Everatt, B. Steffart, and I. Symthe, 'An Eye for the Unusual: Creative Thinking in Dyslexics', *Dyslexia*, 5 (1999): 28-46.
- ⁵³ C. von Károlyi et al., 'Dyslexia Linked to Talent: Global Visual-Spatial Ability', *Brain and Language*, 85 (2003): 430.
- ⁵⁴ J. Logan, 'Dyslexic Entrepreneurs: The Incidence; Their Coping Strategies and Their Business Skills', *Dyslexia*, 15 (2009): 328-46.
- ⁵⁵ D. Appleyard, 'Education: The art of being dyslexic', *The Independent* (1997). On-line, available at < www.independent.co.uk/news/education/education-news/education-the-art-of-being-dyslexic-1280776.html > [Accessed 27 January 2016]
- ⁵⁶ For example, differences in neural organisation between hearing impaired and normal children are thought to result in the development of different thought processes (see S. Levine, 'Hemispheric Specialization and Implications for the Education of the Hearing Impaired', *American Annals of the Deaf*, 131 (1986): 238-242).
- ⁵⁷ R. Greifeneder & H. Bless, 'Depression and Reliance on Ease-of-Retrieval Experiences', *European Journal of Social Psychology*, 38 (2008): 213-230; Morsanyi, et al. (2009), op. cit.
- ⁵⁸ It is possible that unrestricted access to ESTs targeting dyslexia and Asperger's syndrome will not meaningfully reduce the incidence of these conditions. Couples may not choose to select against these conditions. If access to these ESTs has little or no effect on cognitive diversity, then there would be no justification for restricting access to them on our model. We thank an anonymous reviewer for this point.
- ⁵⁹ This is debatable in the dietary supplement example. Some people may hold that these supplements are a type of identity-determining inventions. Therefore if a pregnant woman takes the supplement, she doesn't prevent her specific child from developing a disability, but rather changes which child she ultimately has. If this is true, then the dietary supplement should be considered in the same class as disability screening. However we think the claim that this dietary supplement would be identity altering is not intuitive. Similar prenatal interventions are not normally considered to be identity altering. We normally think that if a woman drinks during pregnancy, for example, she harms that baby, rather than cause a new baby to come into existence. We believe this would also be the case for our hypothetical dietary supplement.
- ⁶⁰ J. L. Taylor and M. M. Seltzer, 'Employment and Post-Secondary Educational Activities for Young Adults with Autism Spectrum Disorders During the Transition to Adulthood', *Journal of Autism and Developmental Disorders*, 41 (2011): 566-74.
- ⁶¹ The parents may, however, be made worse off. This point will be discussed below.
- ⁶² McMahan (2012), op.cit.
- ⁶³ Sparrow (2015), op.cit.
- ⁶⁴ McMahan (2008), op.cit., p. 92

⁶⁵ K. Devolder, 'Preimplantation HLA Typing: Having Children to Save Our Loved Ones', *Journal of Medical Ethics*, 31, 10 (2005): 582–6.

⁶⁶ Australian-Government, 'Ethical Guidelines on the Use of Assisted Reproductive Technology in Clinical Practice and Research' (2007). On-line, available at <http://www.nhmrc.gov.au/files_nhmrc/publications/attachments/e78.pdf> [Accessed 27 January 2016]

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