

Testing Embryos for IQ

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Abstract

In 2018, an American biotechnology company developed a test that could identify if an embryo created through in-vitro fertilisation would become a person with a low intelligence quotient. As the same approach could be used to predict if an embryo will become a person with an above average intelligence quotient, such tests raise questions about reproductive choice and what sort of children prospective parents should have the freedom to create through assisted reproductive technology. Much of the literature on the ethics of selecting for non-disease characteristics was published prior to the development of any test for such characteristics. This article reviews and applies these arguments in the context of the Australian regulatory framework and the technology that is currently available: a test for intelligence quotient. It examines the concept of reproductive liberty and how this concept should be balanced against the welfare of the future child. The article also considers reasons extraneous to the future child's welfare and asks if any such reasons are good enough to restrict the reproductive liberty of prospective parents.

Keywords: Pre-implantation genetic testing; PGT; embryo testing; reproductive liberty; IQ; assisted reproductive technology; ART.

Introduction

In November 2018, it was reported that scientists in the United States had developed a test capable of predicting if an in-vitro embryo will become a person of low intelligence.¹ Developed by biotechnology company Genomic Prediction, the test can identify embryos that have a high chance of becoming a child with an intelligence quotient (IQ) of 25 points below average; the same approach could be used to determine which embryos will develop into individuals of above average intelligence.²

One of the difficulties with testing for non-disease characteristics is that these are often controlled by multiple genes, whereas the conditions for which pre-implantation genetic testing (PGT) is currently employed are single gene disorders.³ However, advances in our understanding of genetics are giving scientists the ability to predict the phenotype of particular combinations of genes with a greater degree of accuracy.⁴ This is done through genome-wide association studies.⁵ By analysing the DNA of hundreds of thousands of individuals, statistical models called 'predictors' are able to identify patterns in people's DNA.⁶ Scientists can then pinpoint the patterns that correspond to various polygenic traits.

As well as screening for IQ, polygenic screening gives prospective parents the opportunity to test the embryos they have created for genetic conditions that are controlled by multiple genes. At present, it is possible to assess an embryo's risk of developing into a person with diabetes,⁷ heart disease⁸ or even schizophrenia.⁹ The generation of a risk score is one of the reasons why polygenic tests are controversial.¹⁰ While PGT for a single gene disorder can give a definitive result about whether an embryo

¹ Wilson, "A New Test."

² Wilson, "A New Test." See also Shulman, "Embryo Selection for Cognitive Enhancement."

³ E.g., Huntington's disease, cystic fibrosis and fragile X syndrome.

⁴ Lello, "Sibling Validation."

⁵ National Human Genome Research Institute, "Genome-Wide Association Studies Fact Sheet."

⁶ Regalado, "Eugenics 2.0."

⁷ Treff, "Utility and First Clinical Application of Screening Embryos for Polygenic Disease Risk Reduction."

⁸ Treff, "Preimplantation Genetic Testing for Polygenic Disease Relative Risk Reduction."

⁹ Tellier, "Embryo Screening for Polygenic Disease Risk," 1106. See also Orchid Health, "Identify Your Healthiest Embryo."

¹⁰ See e.g., Professor Hank Greely, cited in Ball, "Polygenic Screening of Embryos is Here."



will develop into a person with that disorder,¹¹ polygenic embryo screening can only give a probabilistic indication. Therefore, it is possible that an embryo predicted to become a person with an average IQ may actually become a person of extremely high IQ.

The Australian regulatory frameworks for embryo testing limit the use of PGT to tests for genetic conditions, in some cases limiting this further to serious genetic conditions.¹² The regulatory framework for assisted reproductive technology (ART) in Australia is state-based, and only three of the eight states and territories have legislation governing embryo testing.¹³ In states without legislative provisions pertaining to embryo testing, the National Health and Medical Research Council (NHMRC) *Ethical Guidelines on the Use of Assisted Reproductive Technology in Clinical Practice and Research 2017* (NHMRC Guidelines) apply. The NHMRC Guidelines restrict the use of PGT to three situations.¹⁴ The first is to ‘select against genetic conditions, diseases or abnormalities that would severely limit the quality of life of the person who would be born’. Second, to select an embryo that has the potential to save the life of a relative; finally, to increase the chances of a live birth.

The states of Victoria, Western Australia and South Australia all have statutory provisions regulating embryo testing. The *Assisted Reproductive Treatment Act 2008* (Vic) permits PGT to avoid ‘transmitting a genetic abnormality or genetic disease to a child’.¹⁵ The *Human Reproductive Technology Act 1991* (WA) allows PGT where ‘there is a significant risk of a serious genetic abnormality or disease being present in the embryo’.¹⁶ In a similar vein, the *Assisted Reproductive Treatment Act 1988* (SA) prohibits PGT unless ‘there appears to be a risk that a serious genetic defect, serious disease or serious illness would be transmitted to a child conceived naturally’.¹⁷ While terms such as ‘serious illness’ and ‘genetic abnormality’ are not defined in the statutes, it is clear that polygenic screening for non-disease traits falls outside what is currently permitted by the regulatory frameworks.

This article asks whether prospective parents should have the freedom to test embryos for IQ. IQ has been chosen as the focus of this article because it is one of the few polygenic non-disease traits for which an embryo can be tested at present.¹⁸ As much of the ethical discussion of testing for non-disease traits was conceived prior to any such test being developed,¹⁹ this article reconsiders this earlier analysis in the context of the test for IQ. This article reviews the arguments advanced both for and against the use of embryo testing and applies them to selection for IQ. Arguments that support the freedom to undertake such testing include reproductive liberty, advancing the welfare of the future child and the open future argument. Arguments commonly advanced against the use of embryo testing for positive selection include the therapeutic/non-therapeutic distinction, the expressivist objection and the idea of the ‘new’ eugenics. Consideration of these arguments suggests that there may be a case for prospective parents to have the freedom to utilise the test for IQ that is currently available.

IQ

This section asks what IQ is and why it is a characteristic for which prospective parents may wish to test. In the introduction to his 1997 book, Michael Howe noted, ‘being intelligent matters; it makes a big difference to human lives. Sharp men and women thrive. Problems are solved by astute thinkers. Questions get answered by those who are clever.’²⁰

IQ is a measure of intelligence. This begs the question: what is intelligence? A number of different definitions of intelligence are available, and only a small selection are outlined here. The *Oxford Dictionary of English* defines intelligence as ‘the ability to acquire and apply knowledge and skills’.²¹ David Wechsler, the developer of the Wechsler scales,²² has defined intelligence

¹¹ It is worth noting that tests for lower penetrance single gene disorders (e.g., breast cancer) only indicate whether an embryo has the genetic mutations for that disorder. Such tests cannot say whether a person will actually develop, for example, breast cancer.

¹² For a good discussion of the ‘seriousness’ threshold, see Karpin, “Perfecting Pregnancy.”

¹³ New South Wales has ART legislation, but the *Assisted Reproductive Technology Act 2007* (NSW) is silent on this issue of embryo testing.

¹⁴ NHMRC, *Ethical Guidelines* 73 [8.15.1].

¹⁵ *Assisted Reproductive Treatment Act 2008* (Vic) s 10(2)(c).

¹⁶ *Human Reproductive Technology Act 1991* (WA) s 14(2)(b)(a)(ii).

¹⁷ *Assisted Reproductive Treatment Act 1988* (SA) s 9(1)(c)(iii).

¹⁸ Pereira, “Polygenic Embryo Screening,” 1375. The other non-disease trait for which it possible to screen embryos is adult height; see generally, Karavani, “Screening Human Embryos.”

¹⁹ See, e.g., Scott, “Choosing Between Possible Lives,” 171. In 2006, Scott noted that it may never be possible to test for intelligence and, thus, her discussion was purely hypothetical.

²⁰ Howe, *IQ in Question*, 1.

²¹ *Oxford Dictionary of English*, 2324.

²² The Wechsler scales are widely used scales of intelligence. They include the Wechsler Adult Intelligence scale, the Wechsler Intelligence Scale for Children and the Wechsler Preschool and Primary Scale of Intelligence.

as a person's overall capacity to 'act purposefully, to think rationally, and to deal effectively with his environment'.²³ Controversial psychologist Cyril Burt has described it as 'innate general cognitive ability'.²⁴ A broader description was given by Howard Gardner, who suggested that the word 'intelligence' may be used in three distinct ways.²⁵ First, as a 'property of all human beings'.²⁶ Second, as a 'dimension on which human beings differ', and third, to describe the manner in which a task is carried out in pursuit of a goal.²⁷ Further, Gardner noted that there are different kinds of intelligence, such as linguistic intelligence,²⁸ musical intelligence²⁹ and 'logical-mathematical intelligence',³⁰ to name a few.

IQ tests generally measure mathematical skills, verbal communication, memory and spatial awareness.³¹ In turn, these represent broader abilities such as problem-solving skills, comprehension and visual-spatial thinking.³² The problem with using genome-wide association studies to predict IQ is that not all kinds of intelligence are measured by IQ tests. Some types of intelligence, such as musical intelligence, are not measured by such tests. Therefore, an embryo that may become a person with a high level of musical intelligence may not be recognised as such via a genome-wide association study that uses IQ as a basis for predicting intelligence.³³

IQ tests are controversial due to their perceived bias towards the middle class and certain races.³⁴ However, according to Marks, what was traditionally considered to be a race bias may be explained by differences between native and non-native English speakers.³⁵ Consequently, if a test taker is unable to understand the instructions, they will not be able to answer the question.³⁶ To overcome this difficulty, modern IQ tests have been developed to be more culturally sensitive than their predecessors.³⁷ However, overcoming cultural bias is in itself a difficult task; as Suzuki and her colleagues note, 'all tests are to some degree culturally loaded to the extent that they reflect information that is relevant and valued in a cultural context'.³⁸ Nevertheless, modern assessments of IQ have been developed with an understanding of the effect of culture on testing.³⁹ For example, Lanca and Wilner note that for testing to be carried out successfully, the participant must understand the concept of testing, meaning that they are aware that they need to perform at their best.⁴⁰ However, a test taker from a culture that does not value formal assessment may not be familiar with this expectation and may find it uncomfortable.⁴¹ Similarly, some tests must be completed within a specific time frame; however, the necessity to complete a task quickly may also be culturally dependent (with some cultures perceiving speed and quality to be in conflict with each other).⁴² Therefore, modern IQ tests take into account that an interpreter may be involved in the process and also utilise 'multicultural assessment tools'.⁴³ However, it is unclear whether the test takers whose data comprises current genome-wide association studies had access to these multicultural assessments and, therefore, whether the IQ scores represented in such data are free from cultural biases.

Elaine Castles points out that standard IQ tests 'reward conformity and conventional thinking at the expense of creativity and out-of-the-box problem-solving'.⁴⁴ Therefore, only a fraction of human intelligence is reflected in the result of such a test. This

²³ Wechsler, quoted in Bartholomew, *Measuring Intelligence*, 4.

²⁴ Burt, quoted in Bartholomew, *Measuring Intelligence*, 4.

²⁵ Gardner, *Frames of Mind*, xv.

²⁶ Gardner, *Frames of Mind*, xv.

²⁷ Gardner, *Frames of Mind*, xv.

²⁸ Gardner, *Frames of Mind*, 122.

²⁹ Gardner, *Frames of Mind*, 148.

³⁰ Gardner, *Frames of Mind*, 176.

³¹ See, e.g., the Woodcock-Johnson Tests for Cognitive Abilities.

³² Taub, "A Confirmatory Factor Analysis," 74.

³³ There may also be issues with small sample sizes for genome-wide association studies as not everyone has taken an IQ test. Therefore, while genome-wide association study sample sizes of 280,000 exist for IQ, it may be difficult to reach one million.

³⁴ See, e.g., Castles, "Inventing Intelligence," 92. Castles noted that scholastic aptitude test (SAT) scores (which correlate very highly with IQ test scores) show a correlation with parental income that is similar to that of SAT scores and undergraduate grades. Thus, she noted that parental income may be as good an indicator of university success as test scores.

³⁵ Marks, "IQ Variations," 643.

³⁶ Castles, "Inventing Intelligence," 124.

³⁷ Lanca, "Neuropsychology in the Twenty-First Century," 479.

³⁸ Suzuki, "Assessing Intelligence in a Cultural Context," 260.

³⁹ Lanca, "Neuropsychology in the Twenty-First Century," 479.

⁴⁰ Lanca, "Neuropsychology in the Twenty-First Century," 481.

⁴¹ Lanca, "Neuropsychology in the Twenty-First Century," 481.

⁴² Lanca, "Neuropsychology in the Twenty-First Century," 481.

⁴³ Lanca, "Neuropsychology in the Twenty-First Century," 480.

⁴⁴ Castles, "Inventing Intelligence," 124. There is no evidence to suggest that an embryo predicted to develop into a person with a high IQ will not also be creative.

does not, however, suggest that IQ testing is futile. IQ scores show a positive correlation with certain factors, such as income⁴⁵ and success in school.⁴⁶ In deciding whether to use polygenic screening for IQ, prospective parents must consider what sort of children they would like to have — specifically, what qualities they value in their offspring. In the discussion that follows, the scope of prospective parents' reproductive liberty to make these choices will be examined.

The Use of Embryo Testing to Select for IQ

This section considers the arguments for and against the use of embryo testing for non-disease characteristics and applies these to testing and selection for IQ. The use of embryo testing for the selection of non-disease traits is a polarising issue, as the discussion below will highlight. Some academics, such as Julian Savulescu,⁴⁷ do not just argue that prospective parents should have the freedom to make decisions about such tests—they go so far as to suggest that parents have moral reasons for selecting the embryo that is predicted to have the 'best' life. Others, such as Michael Sandel, view children as gifts to be 'received' rather than 'chosen'.⁴⁸

In the following sections, two main arguments in favour of testing will be applied to selection for IQ: the first centring on reproductive liberty and the second on the welfare of the future child.

Reproductive Liberty

Reproductive liberty may be understood as the freedom to make decisions for oneself on matters of reproduction.⁴⁹ As the name suggests, reproductive liberty stems from the concept of liberty, as articulated by John Stuart Mill.⁵⁰ Mill argued that individuals should be free to follow their own life plan without interference, provided that plan does not harm others, 'even though they should think our conduct foolish, perverse or wrong'.⁵¹ This is known as the harm principle, and it has been suggested that this principle should be the 'threshold for justifying state intervention'.⁵² John Robertson notes that reproductive liberty comprises two aspects: 'the liberty to avoid having offspring and the liberty to have offspring'.⁵³ The liberty to have offspring is the relevant liberty for present purposes. Robertson asserts that activities that are 'so closely associated with, or essential to, reproductive decisions' would fall within the scope of reproductive liberty.⁵⁴ Such activities may include acquiring genetic information about an embryo or foetus, or even about the mother herself, because such knowledge may determine whether the individual or couple decide to reproduce.⁵⁵

According to Robertson's conception of reproductive liberty, prospective parents should have the freedom to test embryos for IQ as this information may be determinative of whether they choose to implant the embryos that they have created. Therefore, unless it can be shown that such testing and selection harms the future child, or society more broadly, parents should be free to undertake such tests.

Does Testing for IQ Harm the Future Child?

It was originally thought that high levels of intelligence and creativity were linked to mental illnesses such as schizophrenia and manic depression.⁵⁶ However, more recent studies have shown that intelligence, together with certain 'temperamental traits', can actually have a positive effect on diagnoses of certain mental illnesses,⁵⁷ including major depression and schizophrenia.⁵⁸ Similarly, Erik Mortensen et al found that low levels of intelligence were more commonly associated with

⁴⁵ Zagorsky, "Do you have to be Smart to be Rich?" 494.

⁴⁶ Castles, "Inventing Intelligence," 124.

⁴⁷ Savulescu, "Moral Obligation."

⁴⁸ Sandel, *Case Against Perfection*.

⁴⁹ See generally, Dworkin, *Life's Dominion*.

⁵⁰ Mill, *On Liberty*.

⁵¹ Mill, *On Liberty*, 83.

⁵² Smith, *Saviour Siblings*, 86.

⁵³ Robertson, "Procreative Liberty in the Era of Genomics," 447.

⁵⁴ Robertson, "Procreative Liberty in the Era of Genomics," 448.

⁵⁵ Robertson, "Procreative Liberty in the Era of Genomics," 448.

⁵⁶ See, e.g., Andreassen, "Creativity and Mental Illness." Examples include the legal scholar and Genius Grant winner Elyn Saks (who has schizophrenia) and prominent figures such as Ernest Hemingway (who had manic depression).

⁵⁷ Cederblad, "Intelligence and Temperament as Protective Factors," 16.

⁵⁸ Gale, "Bipolar Disorder More Common in Highly Intelligent People?" 190. It is worth noting that as it is possible to screen an embryo for schizophrenia, prospective parents testing their embryos for IQ would be likely to also utilise a test for schizophrenia.

schizophrenia and other psychotic disorders.⁵⁹ Cederblad and her colleagues suggested that this is because individuals with a high level of intelligence are better able to evaluate their problems accurately and utilise appropriate coping mechanisms.⁶⁰

As well as enabling individuals to cope with challenging situations, intelligence also has positive effects on other aspects of a person's life. Plomin remarks that 'life is an intelligence test'; intelligence affects everything from school performance and social opportunities to even the romantic choices a person makes.⁶¹ Further, he notes that intelligence predicts educational, employment and 'health outcomes better than any other trait'.⁶² This suggests that moderate and high levels of intelligence may be beneficial to a future child in various ways. In addition, low levels of intelligence may be associated with adverse outcomes such as poor school performance and fewer social opportunities. Therefore, applying such findings to the use of polygenic screening to test for IQ, it follows that prospective parents should have the freedom to exercise their reproductive liberty and utilise such tests.

Procreative Beneficence

One way in which prospective parents may wish to exercise their reproductive liberty is by acting in a procreatively beneficent manner. Savulescu's principle of procreative beneficence is the idea that prospective parents 'have a significant moral reason to select the child, of the possible children they could have, whose life is expected ... to go best or at least not worse than any of the others'.⁶³ This reason, Savulescu claims, is that parents should want what is best for their child, and an embryo with the most desirable genetics will benefit more from being born⁶⁴ than a child with a less desirable genetic profile.⁶⁵ Procreative beneficence is founded on the principle of beneficence, defined by Beauchamp and Childress as 'a statement of moral obligation to act for the benefit of others'.⁶⁶ Therefore, to act in a procreatively beneficent manner and, thus, act morally, prospective parents simply need to be acting for the benefit of their future child. Thus, procreative beneficence suggests that prospective parents have good reasons to select the embryo with the genetic makeup that codes for the 'best life'.

One of the criticisms of procreative beneficence stems from the idea of the 'best life'. Critics have argued that the principle is void of real world application because it is impossible to rank possible lives in a way that is coherent and takes into account the 'rich and complex concepts' that together constitute a life.⁶⁷ Savulescu's response to this argument is that it is not a criticism of procreative beneficence but a more general difficulty about placing values on lives.⁶⁸ Even if Savulescu's response is accepted, the assertion that the principle is void of any real world application⁶⁹ becomes a valid criticism in the absence of some kind of method for ranking future lives. While the problems inherent in identifying the 'best life' are not unique to procreative beneficence, they present a general difficulty for testing and selecting for IQ. Therefore, if parents are to be given the freedom to select embryos taking into account potential IQ, this issue must be addressed.

Buchanan et al. ask whether there are acceptable 'or defensible standards for determining what would be the best children possible'.⁷⁰ They state that it:

is important that the attempts to produce the best child possible be understood as making the life of the child best for the child from the standpoint of that particular child's good, not best from some other standpoint, such as the good of the parents or the good of society.⁷¹

This leads to questions such as, would it better for a child to have an above average IQ but poor social skills, or would a child be better equipped with an average IQ and excellent interpersonal skills? Savulescu's answer is that procreative beneficence

⁵⁹ Mortensen, "IQ and Mental Disorder in Young Men," 407. Similar results were reported in Hill, "What Genome-wide Association Studies Reveal About the Association Between Intelligence and Mental Health," 25. Savage et al. have also noted the protective effect of intelligence on schizophrenia; Savage, "Genome-Wide Association Meta-Analyses," 915.

⁶⁰ Cederblad, "Intelligence and Temperament as Protective Factors," 18.

⁶¹ Plomin, "The New Genetics of Intelligence," 148.

⁶² Plomin, "The New Genetics of Intelligence," 148.

⁶³ Savulescu, "The Moral Obligation to Create Children with the Best Chance of the Best Life," 274.

⁶⁴ This assumes a correlation between genetic makeup and wellbeing. Bartels suggests that genetics account for 35% of wellbeing; Bartels, "Genetics of Wellbeing and its Components," 154.

⁶⁵ Savulescu, "The Moral Obligation to Create Children with the Best Chance of the Best Life," 277.

⁶⁶ Beauchamp, *Principles of Biomedical Ethics*, 197.

⁶⁷ Parker, "The Best Possible Child," 281.

⁶⁸ Savulescu, "In Defence of Procreative Beneficence," 284.

⁶⁹ Parker, "The Best Possible Child," 281.

⁷⁰ Buchanan, *From Chance to Choice*, 161.

⁷¹ Buchanan, *From Chance to Choice*, 164.

can be ‘sufficiently determinative’ without precisely ranking each possible embryo.⁷² He suggests that this is because a broadbrush approach to rankings may be possible. For example, it ‘may not be possible to say whether A is better than B, but it may be possible to say that both A or B are better than C. This is enough to rationally reject C.’⁷³ Thus, Savulescu notes that certain sequences of traits may be less desirable than others; therefore, procreative beneficence can still be of value.⁷⁴ Similarly, Sergio Magni notes that while it may be difficult for parents:

to know what is best and to obtain a precise degree of the quality of life of their children ... it may be easy to know what is worst. They may have many doubts about what makes children’s lives better but fewer doubts about what makes children’s lives worse.⁷⁵

Therefore, while it cannot provide definitive answers to the quandary of which traits should be valued over others, the principle of procreative beneficence may still play a valuable role in a regulatory framework for reproductive choice. Given the difficulties inherent in ranking future lives, the principle of procreative beneficence may have a more important role to play in the context of selection against disability.

Does the principle of procreative beneficence suggest that prospective parents should have the freedom to test embryos for IQ? While it may not be possible to say whether a person with a high IQ will go on to have a better life than a person with an average IQ, one use of such testing could be to screen out embryos that will develop into a person with a very low IQ.

The Welfare of the Future Child

This section considers the welfare of the future child and the role this concept should play in decision-making regarding the use of embryo testing to select for IQ. Consideration of the future child’s welfare provides an important justification for curtailing prospective parents’ reproductive liberty. If the welfare of a future child will be stifled due to the circumstances surrounding their conception, this may be a good reason to prevent parents from having access to certain kinds of embryo tests.

References to the welfare of the future child can be found in the statutes of all four of the Australian states that have enacted ART legislation, as well as in the NHMRC Guidelines. For example, the *Assisted Reproductive Treatment Act 2008* (Vic) s 5(a) provides that ‘the welfare and interests of persons born or to be born as a result of treatment procedures are paramount’. Similarly, the *Assisted Reproductive Treatment Act 1988* (SA) s 4A states that the ‘welfare of any child to be born ... must be treated as being of paramount importance’. The *Human Reproductive Technology Act 1991* (WA) does not necessitate that the future child’s welfare is the paramount consideration; however, it requires that ‘the prospective welfare of any child to be born ... is properly taken into consideration’.⁷⁶

When thinking about the welfare of the child, the discussion is often focused on issues pertaining to parental suitability, such as the risk of abuse to the future child or domestic violence.⁷⁷ These risks then provide the basis for refusing treatment to prospective parents. These ‘welfare principles’ are controversial because they attribute rights and interests to a person who has not yet been conceived.⁷⁸ In the context of embryo testing, the issue is slightly different because a number of future children have already been conceived — if implanted, they are potentially nine months away from having actual rights and interests. Pennings notes that the welfare of the child should be a guiding principle in discussions concerning the use of new technologies.⁷⁹ Similarly, Hens and her colleagues suggest that as the wealth of information regarding the genetic profile of an embryo increases, so too does the clinician’s responsibility for the welfare of the future child.⁸⁰

The Open Future Argument

One way in which the welfare of the future child could be enhanced through the use of embryo testing is by giving them an open future. Joel Feinberg’s ‘open future’ argument was first articulated in his paper, ‘The Child’s Right to an Open Future’.⁸¹

⁷² Savulescu, “In Defence of Procreative Beneficence,” 285.

⁷³ Savulescu, “In Defence of Procreative Beneficence,” 285.

⁷⁴ Savulescu, “In Defence of Procreative Beneficence,” 285.

⁷⁵ Magni, “In Defence of Person-Affecting Procreative Beneficence,” 479.

⁷⁶ *Human Reproductive Technology Act 1991* (WA) s 4(1)(d)(iv).

⁷⁷ See, e.g., Pennings, “ESHRE Task Force on Ethics and Law 13.”

⁷⁸ see, e.g., Jackson, “Conception and the Irrelevance of the Welfare Principle.”

⁷⁹ Pennings, “ESHRE Task Force on Ethics and Law 13,” 2587.

⁸⁰ Hens, “Dynamics and Ethics of Comprehensive Preimplantation Genetic Testing,” 370. On a related note, the technology used to test embryos for IQ is the same as that used to test embryos for disabilities; thus, there is no physical harm to the embryo caused by the testing process; Desmyttere, “Neonatal Follow-Up of 995 consecutively born children after embryo biopsy for PGD.”

⁸¹ Feinberg, “The Child’s Right to an Open Future,” 124.

Feinberg introduced us to a category of rights he terms ‘rights in trust’, part of the broader category of children’s rights. He argued that parents should not violate the ‘rights in trust’ they hold for their children.⁸² If they do, they may prematurely close off key future options that child has, thereby denying them the right to an open future. Feinberg’s paper is set against the backdrop of the 1972 US Supreme Court case *Wisconsin v Yoder*,⁸³ which concerned the withdrawal of Amish children from high school two years before they completed their secondary education. By preventing their children from finishing their compulsory education, Amish parents were limiting the opportunities their children would have in the future. Put another way, they were effectively denying their children the right to self-determination.

Applying the open future argument to positive selection is controversial, which is curious because the argument is broadly accepted in the context of negative selection.⁸⁴ If one is willing to accept that the open future argument can be applied to embryos and that prospective parents hold rights in trust for their child from the point at which an embryo is implanted, it is unclear why a distinction should be made between testing for disabilities and testing for IQ. The problem with applying the open future argument in this context is that it supports the proposition that parents *should* use embryo testing to select the embryo with the highest IQ, as this embryo will likely develop into a child with the greatest number of opportunities available to them. However, support for a narrower proposition may be more appropriate in this context—specifically, that providing a child with an open future is a worthwhile endeavour, and regulatory frameworks should, thus, support parents in achieving this.

However, even this weaker proposition is not without its problems. Rob Sparrow argues that rather than trying to provide a child with an open future, parents should simply aim to give their child ‘a reasonable range of valuable life-options’.⁸⁵ He refers to this as ‘a child’s right to a *decent* future’.⁸⁶ To comprise a decent future, Sparrow suggests two conditions must be met. First, ‘the child must have a reasonable range of options available to them in order to ensure that they have a chance of flourishing’.⁸⁷ Second, the options must comprise predominantly of ‘options that could form part of a worthwhile human life’.⁸⁸ Sparrow asserts that a decent future differs from an open future because for a child to have a decent future they do not need to be provided with ‘as many options as possible’.⁸⁹ It is unclear what Sparrow means by a ‘reasonable range of options’ and why this is preferable to Feinberg’s argument that a ‘child’s future [be] left open as much as possible for his own finished self to determine’.⁹⁰ If prospective parents undergo in-vitro fertilisation with PGT and discover that all the embryos are healthy, is this sufficient to satisfy Sparrow’s ‘decent future’ argument?⁹¹ Does this, therefore, mean that parents should not have the freedom to test for IQ? For Sparrow, what is important is that parents are not *required* to provide their future child with more than a decent future. On the other hand, if prospective parents wish to give their child more than a decent future, nothing in Sparrow’s argument suggests that this would be objectionable.

Claudia Mills notes the impossibility and undesirability of trying to give a child ‘an “open” future in any meaningful sense’.⁹² She asserts that it is unclear what is meant by ‘open’ and ‘closed’ options and how these options should be counted and evaluated.⁹³ Mills argues that not all options that are closed when a person is a child remain closed once that person reaches adulthood. She notes, in the context of *Yoder*, that once an Amish child reaches adulthood, they may leave the Amish community and are then free to pursue a future that was previously closed to them. Applying this to embryo testing for IQ, prospective parents who choose not to utilise such testing may later decide to test the IQ of their child. It has also been found that a child’s environment has an impact on their cognitive development, with factors such as mental stimulation and good nutrition having a positive impact on a child’s cognitive ability.⁹⁴ Therefore, even parents who do not employ embryo testing for IQ cannot necessarily be accused of depriving their child of an open future.

It should be borne in mind that the use of embryo testing to select for IQ does not guarantee a child who is significantly above average. It simply allows prospective parents to select the embryo, out of the possible embryos available, that will become a

⁸² Feinberg, “The Child’s Right to an Open Future,” 126.

⁸³ *Wisconsin v Yoder* 406 US 205 (1972).

⁸⁴ See, e.g., de Souza, “Regulating Preimplantation Genetic Diagnosis in Australia,” 929–930; Davis, “Genetic Dilemmas and the Child’s Right to an Open Future,” 7.

⁸⁵ Sparrow, “A Child’s Right to a Decent Future?” 366.

⁸⁶ Sparrow, “A Child’s Right to a Decent Future?” 366.

⁸⁷ Sparrow, “A Child’s Right to a Decent Future?” 366.

⁸⁸ Sparrow, “A Child’s Right to a Decent Future?” 366.

⁸⁹ Sparrow, “A Child’s Right to a Decent Future?” 366.

⁹⁰ Feinberg, “The Child’s Right to an Open Future,” 151.

⁹¹ This does not suggest that embryos with a genetic condition cannot have a ‘decent future’. Sparrow suggests that even embryos that have a disability may have a ‘decent future’; Sparrow, “A Child’s Right to a Decent Future?” 366.

⁹² Mills, “The Child’s Right to an Open Future?” 499.

⁹³ Mills, “The Child’s Right to an Open Future?” 499.

⁹⁴ Oommen, “Factors Influencing Intelligence Quotient,” 24.

child who is likely to have more opportunities than the other possible children who could have been born. Consider a couple who have created three embryos. Embryo A will become a person of average intelligence, perhaps (for the sake of argument) at the lower end of the normal range. Embryo B will also develop into a person of average intelligence, and embryo C into a person of above average intelligence. All three embryos are healthy; without testing, embryo A will be randomly chosen. If embryo A is carried to term, embryos B and C will be donated for use in research. However, if tests for IQ are permitted, the prospective parents may choose to test their embryos and will likely choose embryo C.⁹⁵ This is because the opportunities that will be available to embryo C exceed those available to embryos A and B.⁹⁶ Therefore, once embryo C grows up, they will not only have the opportunity to exercise the options that would have been available to embryos A and B but may also have an additional set of options. However, the options available to embryo C (e.g., attending a university of their choice and studying any subject they choose or founding a game-changing start-up) might not have been available to embryos A or B. Thus, the future for embryo C is more *open* than the futures available to embryos A and B (both of which would still be worthwhile).

One of the potential disadvantages of this approach to selection is that having an open future may actually be detrimental to a child's welfare.⁹⁷ This is because substantial choice can lead 'to anxiety and indecision', whereas adhering to one path from an early age and following a rigorous training schedule may be more conducive to adult success.⁹⁸ A further possible disadvantage of selection for IQ is that if parents have knowledge of their child's intellectual abilities even before that child is born, they may only allow the child to undertake activities in which there is a good chance they will excel. This would effectively deny the child valuable experiences that may help shape them into a well-rounded adult. However, this could also be said of parents who, without using embryo testing, realise their child's skills and talents at an early age and is thus, not in and of itself a reason to prevent those parents who genuinely wish to give their child an open future being able to do so.

Also potentially problematic is that a child selected on the basis of their IQ may feel pressure to perform well at school to keep their future open. While this would be an unfortunate consequence of polygenic screening, such pressure may also be felt by children who, from an early age, are assessed as gifted. Therefore, if a gifted child is randomly selected at the embryo stage, their experience would be no different to a gifted child deliberately selected following embryo testing. Thus, it is not selection itself that is problematic, but rather the expectations placed on the child by their family.⁹⁹

Giving prospective parents the freedom to provide their child with an open future through ART is comparable with the considerable freedom afforded to parents to use a variety of environmental resources to provide their child with the best possible life.¹⁰⁰ As there is no evidence to suggest that providing a child with an open future is detrimental to the child's welfare, parents should have the freedom to test for IQ in their future offspring.

The Therapeutic/Non-therapeutic Distinction

The therapeutic/non-therapeutic distinction, also known as the treatment–enhancement or therapy–enhancement¹⁰¹ distinction, is the idea that medical procedures, such as embryo testing, are acceptable for therapeutic purposes, such as avoiding the birth of individuals with disabilities, but unacceptable for non-therapeutic purposes, such as selecting the most intelligent child.¹⁰² The roots of the distinction lie in the concept of medical necessity.¹⁰³ Therefore, to qualify as medically necessary, a procedure must treat or prevent a medical condition or disability. The therapeutic/non-therapeutic distinction is also perceived to represent the moral boundary between procedures that are permissible and those that are impermissible.¹⁰⁴ As Resnik notes, one reason therapeutic procedures are considered moral is that they promote 'the goals of medicine', whereas non-therapeutic procedures may be perceived as having 'morally questionable goals'.¹⁰⁵ However, this boundary is not set in stone,¹⁰⁶ and the most that can be said in support of it is that 'it defines moral zones without any sharp boundaries'.¹⁰⁷

⁹⁵ It is assumed that anyone utilising such a test will do so because they value intelligence as a characteristic in their future offspring.

⁹⁶ This is not to suggest that embryo C will be more successful than embryos A or B would have been.

⁹⁷ Buchanan, *From Chance to Choice*, 171.

⁹⁸ Buchanan, *From Chance to Choice*, 171.

⁹⁹ This issue could be ameliorated through genetic counselling.

¹⁰⁰ Buchanan, *From Chance to Choice*, 171.

¹⁰¹ The terms 'treatment-enhancement' and 'therapy-enhancement' often appear in American literature. However, they are confusing in the context of selection as embryos are being neither treated nor enhanced.

¹⁰² The distinction between therapeutic and non-therapeutic treatment is also used in other areas of law and medicine; see, e.g., *Marion's Case* (1992) 175 CLR 218.

¹⁰³ Daniels, "Normal Functioning and the Treatment-Enhancement Distinction," 309.

¹⁰⁴ Resnik, "The Moral Significance of the Therapy-Enhancement Distinction," 365.

¹⁰⁵ Resnik, "The Moral Significance of the Therapy-Enhancement Distinction," 365.

¹⁰⁶ Resnik, "The Moral Significance of the Therapy-Enhancement Distinction," 365.

¹⁰⁷ Resnik, "The Moral Significance of the Therapy-Enhancement Distinction," 374.

Buchanan et al argue that ‘no reasonable defense of the treatment/enhancement distinction is possible if we expect too much of it’.¹⁰⁸ Further, they note that even if the ‘distinction does not provide us with a simple criterion for deciding what genetic interventions are permissible and impermissible, there is good reason to think that many enhancements will pose serious problems not posed by treatments’.¹⁰⁹ One example cited by the authors is the issue of competitive advantage.¹¹⁰ They note that if everyone selects in favour of a particular trait, the advantage conferred by that trait ceases to exist. This is not a persuasive concern in the context of embryo testing because parents are testing and selecting for characteristics already present in the embryo. Therefore, it is difficult to argue that the use of embryo testing for this purpose would be futile. Further, in the context of a test for IQ, the advantages presented by higher levels of intelligence are beneficial whether or not a competitive advantage is conferred (e.g., as intelligence positively affects health outcomes,¹¹¹ it is better for both individuals and society as a whole if everyone was healthier).

Isabel Karpin and Roxanne Mykitiuk argue that the ‘distinction is inadequate and unhelpful to guide ethical analysis and medical and regulatory decision making’.¹¹² They suggest that one example of where the distinction struggles is in the context of carrier embryos¹¹³ and question whether selecting against carrier embryos is really therapy when the purpose of such selection is to ensure the future child does not themselves face a reproductive dilemma.¹¹⁴ However, selection against carrier embryos is acceptable in many regulatory frameworks.¹¹⁵ The applicability of the therapeutic/non-therapeutic distinction to embryo testing is also questionable because even where the technology is used for negative selection (i.e. to select against genetic conditions), no one is actually being ‘treated’. This is because one embryo is being selected for implantation over an alternative embryo.

Having considered the therapeutic/non-therapeutic distinction, it is concluded that this distinction does not represent a sound moral reason to prevent prospective parents from using embryo testing to select for IQ. While the distinction may have some limited use, the arbitrariness of the distinction prevents it from being a useful tool in the regulation of embryo testing.

The Expressivist Objection

The expressivist objection is the argument that using PGT to test for and select against disability reflects negative or discriminatory attitudes towards people with disabilities.¹¹⁶ In the context of selection for IQ, the expressivist objection may suggest that people who are of lower IQ, or less intelligent, are less valuable or, at the very least, less fortunate. An alternative form of the objection is that if society permits testing of this kind, governments are expressing these attitudes about certain characteristics.¹¹⁷ Dan Brock argued that it is not specifically positive selection that sends these hurtful messages to individuals, but rather the ‘underlying attitude or value judgment that these are desirable traits to have’ and those who do not have them lack something that society considers valuable.¹¹⁸ Further, Brock noted that the attitude that it is desirable to have certain abilities (e.g., intelligence) is justified and, on the whole, uncontroversial.¹¹⁹ Consequently, he asserted that it ‘is an unavoidable consequence of that justified evaluation that some will hear the message that it is unfortunate or bad if one has [a lower IQ], and this may be hurtful to those who in fact have’ a lower IQ.¹²⁰ As Brock pointed out, the only way to avoid sending potentially hurtful messages would be to abstain from all judgements about which traits are more or less desirable.¹²¹ However, as it would be impossible and undesirable to avoid making any judgements of this kind,¹²² the expressivist objection is not a valid argument to prevent prospective parents from using embryo testing to select for IQ in their future offspring.

¹⁰⁸ Buchanan, *From Chance to Choice*, 119.

¹⁰⁹ Buchanan, *From Chance to Choice*, 154.

¹¹⁰ This point has also been made by others, e.g., Glover, “Choosing Children,” 80.

¹¹¹ Plomin, “The New Genetics of Intelligence,” 148.

¹¹² Karpin, “Going Out on a Limb,” 413.

¹¹³ Carrier embryos are embryos with the genotype for a disease (e.g., cystic fibrosis); but once the embryo becomes a child, that child will themselves not have the illness. However, they may pass the disease onto their offspring.

¹¹⁴ Karpin, “Going out on a Limb,” 434.

¹¹⁵ For example, this use of PGT is not prohibited by the NHMRC Ethical Guidelines or by any of the statutes regulating ART in Australian states.

¹¹⁶ See generally, Holm, “The Expressivist Objection to Prenatal Diagnosis”; Edwards, “Disability, Identity and the Expressivist Objection.”

¹¹⁷ Holm, “The Expressivist Objection to Prenatal Diagnosis,” 24.

¹¹⁸ Brock, “Is Selection of Children Wrong?” 264–265.

¹¹⁹ Brock, “Is Selection of Children Wrong?” 265.

¹²⁰ Brock, “Is Selection of Children Wrong?” 265.

¹²¹ Brock, “Is Selection of Children Wrong?” 265.

¹²² Brock, “Is Selection of Children Wrong?” 265.

Liberal Eugenics

A further argument against permitting embryo testing for IQ is that such testing is a eugenic practice and, therefore, should be prohibited.¹²³ This section considers what the term eugenics means and if a test should be prohibited simply because it falls within the definition of a eugenic practice.

Eugenics, which comes from the Greek words for ‘good’ and ‘birth’, often has negative connotations.¹²⁴ While eugenic ideas can be traced back to the Ancient Greeks,¹²⁵ and laws sanctioning eugenics have existed since the early 1900s,¹²⁶ the term is most commonly associated with the forced sterilisations and genocide that were carried out in Nazi Germany.¹²⁷ Despite this, supporters of the liberal eugenics movement argue that to move away from the term ‘eugenics’ would be to silence this dark history and risk ‘repeating past errors by dissociating them from their historical misuse’.¹²⁸ Unlike traditional eugenics, which is concerned with improving offspring through the avoidance of disability and is associated with historical atrocities, liberal eugenics is concerned with empowering prospective parents with the freedom to choose offspring with advantageous characteristics. Further, the term liberal eugenics is most commonly found in the context of discussions around enhancement.

Liberal eugenics is concerned more with providing prospective parents with the freedom to make choices regarding their offspring and less with improving the gene pool for the good of society. As Nicholas Agar notes, ‘authoritarian eugenicists would do away with ordinary procreative freedoms. Liberals instead propose radical extensions of them.’¹²⁹ Agar argues that ‘respect for the life plans of future persons can constrain parental choice in a way that sharply distinguishes the new eugenics from its ugly ancestor’.¹³⁰ This is because acknowledging that future people need access to a variety of ‘potential life plans’ will prevent the selection of embryos only capable of pursuing one possible way of life.¹³¹ This aligns well with the idea of providing children with an open future, discussed earlier in this article. Agar points out that the ‘liberal juxtaposition of eugenics with education’ provides a good framework for parental choice.¹³² He asserts that the aims of education go far beyond the avoidance of disease or disability and ‘are concerned with the person’s well-being, welfare or quality of life’.¹³³ In much the same way, the regulation of embryo testing should look beyond selection against disability. However, Sparrow argues that in making decisions about the characteristics of their offspring, prospective parents are making decisions about the value of certain traits.¹³⁴ He suggests that this is similar to the old eugenics programs where the state made decisions about what future societies should look like.¹³⁵ Conversely, Agar states that the close attention paid to the wellbeing of future children and the diversity of parental choices will produce better results than state-sponsored mass eugenics programs.¹³⁶

Michael Sandel worries that liberal eugenics may eventually lead to a state-sponsored liberal eugenics program.¹³⁷ Sandel argues that permitting parents to use embryo testing to select characteristics such as IQ could pave the way for the state to require parents to use genetic technology in this way.¹³⁸ Further, he points out that liberal eugenics would not, in fact, reject state-imposed use of genetic technology, provided that use respected the autonomy of the future child.¹³⁹ It may, however, be argued that this is not a legitimate concern. Taking their lead from Diane Paul, Buchanan and his colleagues suggest that as reproductive freedom is so different today than it was during the early to mid-20th century, ‘history is virtually certain not to repeat itself. The state is not likely to begin any new campaign of ... intrusion into reproductive freedom for the sake of society’s genes, no matter how much is learned about what these genes do.’¹⁴⁰

¹²³ See, e.g., Garland-Thomson, “Human Biodiversity Conservation,” 14. Rosemarie Garland-Thomson argued that embryo testing generally, regardless of its purpose, is ‘a velvet eugenics’.

¹²⁴ See, e.g., Wilkinson, “‘Eugenics Talk’ and the Language of Bioethics.”

¹²⁵ Galton, “Greek Theories on Eugenics.”

¹²⁶ See, e.g., *1907 Indiana Eugenics Law*, Ind Code ch 215.

¹²⁷ Jonathan Anomaly notes that rather than being eugenic, the Holocaust was dysgenic. Citing evidence indicating that Ashkenazi Jews have extremely high IQs, Anomaly points out that a eugenic policy would have actually encouraged Jews to breed; Anomaly, “Defending Eugenics,” 26.

¹²⁸ Veit, “Can ‘Eugenics’ be Defended?” 63. A similar point is made by Agar, “Why We Should Defend Gene Editing as Eugenics.”

¹²⁹ Agar, “Liberal Eugenics,” 137.

¹³⁰ Agar, “Liberal Eugenics,” 137.

¹³¹ Agar, “Liberal Eugenics,” 138.

¹³² Agar, “Liberal Eugenics,” 142.

¹³³ Agar, “Liberal Eugenics,” 142.

¹³⁴ Sparrow, “Liberalism and Eugenics,” 500.

¹³⁵ Sparrow, “Liberalism and Eugenics,” 500.

¹³⁶ Agar, “Liberal Eugenics,” 142.

¹³⁷ While Sandel’s arguments are framed in the context of genetic engineering, they can be applied to selection.

¹³⁸ Sandel, *The Case Against Perfection*, 79.

¹³⁹ Sandel, *The Case Against Perfection*, 79.

¹⁴⁰ Buchanan, *From Chance to Choice*, 322. See also Paul, “The Hidden Science of Eugenics.”

Nevertheless, Buchanan et al. note that while state-imposed eugenics is unlikely, social pressure may effectively force prospective parents to use genetic technology for positive eugenics related purposes.¹⁴¹ The effects of social pressure of this kind can be seen in the movie *Gattaca*, where the widespread use of embryo testing to select the most desirable embryos leads to discrimination against those who were not selected, known as ‘faith children’ or ‘de-gene-erates’.¹⁴² While *Gattaca* is fiction, one can envisage a similar situation arising in the future. Widespread discrimination of this kind would clearly be unacceptable. However, rather than citing this as an argument against the use of embryo testing for positive selection, the issue of widespread discrimination may instead be considered a target for regulation.

Discussion in this area must move away from eugenics and, in particular, the idea that reproductive choice falls within the concept of eugenics. While liberal eugenics attempts to balance reproductive liberty with a cautious reminder about past atrocities, the term still attracts stigma from those who oppose embryo testing. It should also be borne in mind that characterising as eugenic the use of a test that enables prospective parents to test embryos for IQ is a mischaracterisation of eugenics.¹⁴³ As Robert Wilson notes, the eugenics movement ‘was not about producing people with traits that enable them to thrive’.¹⁴⁴ Rather, eugenic thinking focused on improving society by preventing the birth of children who the state considered would inherit undesirable genes.¹⁴⁵

The Child-Gift Analogy

The child-gift analogy¹⁴⁶ is the idea that to ‘appreciate children as gifts is to accept them as they come, not as objects of our design or products of our will, or instruments of our ambition’.¹⁴⁷ This argument is premised on two ideals: first, that ‘the virtuous attitude towards gifts is one of acceptance and gratitude’ and, second, that the exact nature of the gift is not chosen by the recipient.¹⁴⁸ Applying this to children, it may be suggested that parents should be grateful and accepting of the child they have been given because their child is a gift they have been lucky to receive. Further, just as a gift is not chosen by the recipient, prospective parents should not expect to choose the characteristics of their children.¹⁴⁹ However, Wilkinson argues that there are many cases where the recipient of a gift has chosen it, and it cannot be said that this practice is morally wrong.¹⁵⁰ Therefore, according to Wilkinson, if we accept the child-gift analogy, it follows that it is not morally wrong to choose the nature of our children.

Brock has suggested that the idea that children are gifts is closely related to the ‘playing God’ argument,¹⁵¹ according to which children are gifts from God and should be accepted unconditionally. However, it is difficult to see why this makes selection problematic. In both selection for IQ and selection against disability, parents are seeking to provide their child with the best possible life. The attitude of wanting the best for one’s child is by no means incompatible with providing unconditional love for a child. Therefore, it is unclear why the idea of children being gifts is incompatible with testing embryos for IQ.

One prominent proponent of the child-gift analogy is Michael Sandel. Sandel’s arguments, while framed in the context of enhancement, can also be applied to the positive selection of embryos. He argues that such practices represent ‘the one-sided triumph of wilfulness over giftedness, of dominion over reverence, of molding over beholding’.¹⁵² For Sandel, the positive selection of embryos would cause an erosion of ‘our appreciation of the gifted character of our human powers and achievements’ and will lead to a change in our moral landscape in three important areas: ‘humility, responsibility and solidarity’.¹⁵³ Sandel argues that in a ‘world that prizes mastery and control, parenthood is a school for humility’.¹⁵⁴ Further, he asserts that not being able to select one’s offspring ‘teaches parents to be open to the unbidden’.¹⁵⁵ Such openness, Sandel suggests, ‘invites us to abide the unexpected, to live with dissonance, to reign in the impulse to control’.¹⁵⁶

¹⁴¹ Buchanan, *From Chance to Choice*, 322.

¹⁴² Nicol, *Gattaca*.

¹⁴³ Wilson, “Eugenics Undefined,” 71.

¹⁴⁴ Wilson, “Eugenics Undefined,” 69.

¹⁴⁵ Wilson, “Eugenics Undefined,” 70.

¹⁴⁶ This expression has been borrowed from Stephen Wilkinson; Wilkinson, *Choosing Tomorrow’s Children*, 40.

¹⁴⁷ Sandel, *The Case Against Perfection*, 45.

¹⁴⁸ Wilkinson, *Choosing Tomorrow’s Children*, 40.

¹⁴⁹ It should be noted that these arguments could be applied to both the selection and enhancement of embryos.

¹⁵⁰ Wilkinson, *Choosing Tomorrow’s Children*, 40.

¹⁵¹ Brock, “Is Selection of Children Wrong?” 267.

¹⁵² Sandel, “The Case Against Perfection,” 85.

¹⁵³ Sandel, “The Case Against Perfection,” 86.

¹⁵⁴ Sandel, “The Case Against Perfection,” 86.

¹⁵⁵ Sandel, “The Case Against Perfection,” 86.

¹⁵⁶ Sandel, “The Case Against Perfection,” 86.

Frances Kamm argues that even if prospective parents have a desire for mastery, this is not necessarily wrong, provided that it is a means to a positive end, such as health or intelligence.¹⁵⁷ Further, she notes that ‘a desire for mastery is not inconsistent with an openness to the unbidden that Sandel emphasizes’.¹⁵⁸ This is because we can appreciate positive outcomes that we did not deliberately bring about while simultaneously being happy about the things we intentionally brought about. Consequently, Kamm suggests that being open to the unbidden does not ‘necessarily imply a willingness to accept whatever comes even if it is bad when one could change it’.¹⁵⁹ This suggests that permitting the testing and selection of embryos for IQ is not synonymous with being closed to the unbidden or with a shift in the humility of prospective parents.

The child-gift analogy fails to show convincingly that embryo testing for IQ should be prohibited. While the concepts of unconditional love and acceptance are important aspects of the parent–child relationship, no evidence exists to suggest that this would be eroded by the option to select for IQ in embryos. The child-gift analogy also fails because selection against disability is permitted in Australia, and the argument that children should not be chosen applies equally in the context of avoiding disabilities.

Conclusion

In *Gattaca*, a geneticist advises prospective parents: ‘you want to give your child the best possible start. Believe me, we have enough imperfection built in already. Your child doesn’t need any additional burdens. Keep in mind, this child is still you. Simply, the best of you.’¹⁶⁰ Although a work of fiction, this quote reminds us how far ART has come since the birth of Louise Brown in 1978.¹⁶¹ ART is no longer solely a means by which infertile couples can have a genetically related child. It now involves choices that go beyond the decision of whether to reproduce.

The role of regulation in this sphere is to balance the reproductive liberty of prospective parents with the welfare of the future child. Permitting selection for IQ allows parents to exercise their reproductive liberty, and there is a presumption in favour of liberty unless its exercise will cause harm to a person or society. In exercising their reproductive liberty, prospective parents may choose to act in a procreatively beneficent manner and select the embryo that is most likely to develop into a child with an IQ higher than the other possible children that could have been born.

This article has also asked whether there are reasons extraneous to a child’s welfare that should have an impact on the reproductive liberty of prospective parents. Four arguments were considered in this regard. First, it was argued that the therapeutic/non-therapeutic distinction is not a useful regulatory tool. Its applicability in the context of embryo testing is also limited because even where the technology is used for negative selection, no one is being ‘treated’; rather, one embryo is being chosen over another. Second, the expressivist objection failed to present a convincing case for preventing parents from selecting for IQ. Central to the expressivist objection is the attitude that is conveyed during the course of making positive and negative judgements. As it is undesirable, if not impossible, to avoid making such judgements, the expressivist objection must fail. Third, liberal eugenics has been considered as a reason to prevent parents from selecting for IQ. Liberal eugenics works hard to distinguish itself from the eugenic practices of previous centuries; further, given the changes in reproductive freedom, it is suggested that referring to a practice as falling within the definition of liberal eugenics does not represent a sound reason to prohibit it. Finally, the child-gift analogy was examined but found to carry little weight. To argue that parents should not have the freedom to choose their children (just as a gift recipient does not choose a gift) applies equally to both testing for IQ and testing for disabilities. Therefore, if the analogy is not sufficient to prohibit the use of embryo testing for selection against disabilities, it is equally weak in the context of embryo testing for IQ.

This article has reviewed the arguments for and against the use of embryo testing for positive selection and applied them to a test for IQ. As the arguments opposing selection for IQ do not present a convincing case against this practice, it is concluded that prospective parents should have the freedom to test embryos for IQ.

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¹⁵⁷ Kamm, “What Is and Is Not Wrong with Enhancement,” 94.

¹⁵⁸ Kamm, “What Is and Is Not Wrong with Enhancement,” 94.

¹⁵⁹ Kamm, “What Is and Is Not Wrong with Enhancement,” 94.

¹⁶⁰ Nicol, *Gattaca*.

¹⁶¹ In July 1978, Louise Brown became the first baby born following an in vitro fertilisation procedure.

Bibliography

- Agar, Nicholas. "Liberal Eugenics." *Public Affairs Quarterly* 12 (1998): 137–155. <http://www.jstor.org/stable/40441188>
- Agar, Nicholas. "Why We Should Defend Gene Editing as Eugenics." *Cambridge Quarterly of Healthcare Ethics* 28 (2019): 9–19. <https://doi.org/10.1017/s0963180118000336>
- Andreasen, Nancy C. "Creativity and Mental Illness." *American Journal of Psychiatry* 144 (1987): 1288–1292. <https://doi.org/10.1176/ajp.144.10.1288>
- Anomaly, Jonathan. "Defending Eugenics: From Cryptic Choice to Conscious Selection." *Monash Bioethics Review* 35, no 1 (2018): 24–35. <https://doi.org/10.1007/s40592-018-0081-2>
- Ball, Philip. "Polygenic Screening of Embryos is Here, but is it Ethical?" *The Guardian*, 17 October 2021. <https://www.theguardian.com/science/2021/oct/17/polygenic-screening-of-embryos-is-here-but-is-it-ethical>
- Bartels, Meike. "Genetics of Wellbeing and its Components Satisfaction with Life, Happiness, and Quality of Life: A Review and Meta-Analysis of Heritability Studies." *Behavioural Genetics* 45 (2015): 137–156. <https://doi.org/10.1007%2Fs10519-015-9713-y>
- Bartholomew, David J. *Measuring Intelligence: Facts and Fallacies*. Cambridge: Cambridge University Press, 2004.
- Beauchamp, Tom L and James F Childress. *Principles of Biomedical Ethics*. New York: Oxford University Press, 6th ed, 2009.
- Brock, Dan W. "Is Selection of Children Wrong?" In *Human Enhancement*, edited by Julian Savulescu and Nick Bostrom, 251–276. Oxford: Oxford University Press, 2009.
- Buchanan, Allen et al. *From Chance to Choice: Genetics and Justice*. Cambridge: Cambridge University Press, 2000.
- Castles, Elaine. *Inventing Intelligence: How Americans Came to Worship IQ*. Santa Barbara: Praeger, 2012.
- Cederblad, Marianne, Lisa Dahlin, Olle Hagnell and Kjell Hansson. "Intelligence and Temperament as Protective Factors for Mental Health: A Cross-Sectional and Prospective Epidemiological Study." *European Archives of Psychiatry and Clinical Neuroscience* 245, no 1 (1995): 11–19. <https://doi.org/10.1007/bf02191539>
- Chikovani, George, Lasha Babuadze, Nino Iashvili, Tamar Gvalia and Simon Surguladze. "Empathy Costs: Negative Emotional Bias in High Empathisers." *Psychiatry Research* 229, no 1 (2015): 340. <https://doi.org/10.1016/j.psychres.2015.07.001>
- Daniels, Norman. "Normal Functioning and the Treatment-Enhancement Distinction." *Cambridge Quarterly of Healthcare Ethics* 9 (2000): 309–322. <https://doi.org/10.1017/s0963180100903037>
- Davis, Dena S. "Genetic Dilemmas and the Child's Right to an Open Future." *Hastings Center Report* 27, no 2 (1997): 7–15.
- de Souza, Michelle. "Regulating Preimplantation Genetic Diagnosis in Australia: Disability and Parental Choice." *Journal of Law and Medicine* 22 (2015): 915–933.
- Desmytere, Sonja, M. De Rycke, C. Staessen, I. Liebaers, F. De Schrijver, W. Verpoest, P. Haentjens, and Maryse Bonduelle. "Neonatal Follow-Up of 995 Consecutively Born Children after Embryo Biopsy for PGD." *Human Reproduction* 27 no 1 (2011): 288–293. <https://doi.org/10.1093/humrep/der360>
- Dickens, William T and James R Flynn. "Heritability Estimates Versus Large Environmental Effects: The IQ Paradox Resolved." *Psychological Review* 108, no 2 (2001): 346–369. <https://doi.org/10.1037/0033-295X.108.2.346>
- Dworkin, Ronald. *Life's Dominion: An Argument about Abortion, Euthanasia and Individual Freedom*. New York: Vintage Books, 1994.
- Edwards, Steven D. "Disability, Identity and the "Expressivist Objection"." *Journal of Medical Ethics* 30 (2004): 418–420. <http://dx.doi.org/10.1136/jme.2002.002634>
- Feinberg, Joel. "The Child's Right to an Open Future." In *Whose Child? Children's Rights, Parental Authority and State Power*, edited by William Aiken and Hugh LaFollette, 124–153. Littlefield: Adams & Co, 1980.
- Gale, C. R., G. D. Batty, A. M. McIntosh and D. J. Porteous. "Is Bipolar Disorder More Common in Highly Intelligent People? A Cohort Study of a Million Men." *Molecular Psychiatry* 18 (2013): 190–194. <https://doi.org/10.1038/mp.2012.26>
- Galton, David J. "Greek Theories on Eugenics." *Journal of Medical Ethics* 24, no 4 (1998): 263–267. <https://doi.org/10.1136%2Fjme.24.4.263>
- Gardner, Howard. *Frames of Mind: The Theory of Multiple Intelligences*. New York: Basic Books, 2011.
- Garland-Thomson, Rosemarie "Human Biodiversity Conservation: A Consensual Ethical Principle." *American Journal of Bioethics* 15, no 6 (2015): 13–15. <http://dx.doi.org/10.1080/15265161.2015.1028663>
- Howe, Michael. *IQ in Question*. London: SAGE Publications, 1997.
- Glover, Jonathan. *Choosing Children: Genes, Disability and Design*. Oxford: Oxford University Press, 2006.
- Hens, Kristien, Wybo Dondorp, Alan H. Handyside, Joyce Harper, Ainsley J. Newson, Guido Pennings, Christoph Rehmann-Sutter and Guido de Wert. "Dynamics and Ethics of Comprehensive Preimplantation Genetic Testing: A Review of the Challenges." *Human Reproduction Update* 19, no 4 (2013): 366–375. <https://doi.org/10.1093/humupd/dmt009>

- Hill, David W., Sarah E. Harris and Ian J. Deary. "What Genome-Wide Association Studies Reveal about the Association between Intelligence and Mental Health." *Current Opinion in Psychology* 27 (2019): 25–30. <https://doi.org/10.1016/j.copsyc.2018.07.007>
- Holm, Soren. "The Expressivist Objection to Prenatal Diagnosis: Can it Be Laid to Rest?" *Journal of Medical Ethics* 34, no 1 (2008): 24–25. <https://doi.org/10.1136/jme.2006.019984>
- Jackson, Emily. "Conception and the Irrelevance of the Welfare Principle." *The Modern Law Review* 65 (2002): 176–203. <https://doi.org/10.1111/1468-2230.00374>
- Kamm, Frances. "What Is and Is Not Wrong with Enhancement." In *Human Enhancement*, edited by Julian Savulescu and Nick Bostrom, 91–130. Oxford: Oxford University Press, 2009.
- Karavani, Ehud, Or Zuk, Danny Zeevi, Nir Barzilai, Nokis C. Stefanis, Alex Hatzimanolis, Nikolaos Smyrnis, Dimitrios Avramopoulos, Leonid Kruglyak, Gil Atzmon, Max Lam, Todd Lencz and Shai Carmi. "Screening Human Embryos for Polygenic Traits has Limited Utility." *Cell* 179 (2019): 1424–1435. <https://doi.org/10.1016/j.cell.2019.10.033>
- Karpin, Isabel and Roxanne Mykitiuk. "Going out on a Limb: Prosthetics, Normalcy and Disputing the Therapy/Enhancement Distinction." *Medical Law Review* 16 (2008): 413–436. <https://doi.org/10.1093/medlaw/fwn018>
- Karpin, Isabel and Kristin Savell. *Perfecting Pregnancy: Law, Disability, and the Future of Reproduction*. Cambridge: Cambridge University Press, 2012.
- Lanca, Margaret and Emily K Wilner. "Neuropsychology in the Twenty-First Century: The Rise of Multicultural Assessments." In *Physician's Field Guide to Neuropsychology: Collaboration through Case Example*, edited by Karen M Sanders, 479–493. New York: Springer, 2019.
- Lello, Louis, Timothy G. Raben and Stephen D. H. Hsu. "Sibling Validation of Polygenic Risk Scores and Complex Trait Prediction." *Scientific Reports* 10, no 1 (2020): 13190. <https://doi.org/10.1038/s41598-020-69927-7>
- Lev, Ori. "Will Biomedical Enhancements Undermine Solidarity, Responsibility, Equality and Autonomy?" *Bioethics* 25, no 4 (2011): 177–184. <https://doi.org/10.1111%2Fj.1467-8519.2009.01779.x>
- Magni, Sergio Filippo. "In Defence of Person-Affecting Procreative Beneficence." *Bioethics* 35, no 5 (2021): 473–479. <https://doi.org/10.1111/bioe.12872>
- Marks, David F. "IQ Variations across Time, Race and Nationality: An Artifact of Differences in Literacy Skills." *Psychological Reports* 107, no 3 (2010): 643–664. <https://doi.org/10.2466/pr0.106.3.643-664>
- Mill, John Stuart. *On Liberty*. New Haven: Yale University Press, 2003. First published 1859 by John W Parker & Son (London).
- Mills, Claudia. "The Child's Right to an Open Future?" *Journal of Social Philosophy* 34 (2003): 499–509. <https://doi.org/10.1111/1467-9833.00197>
- Mortensen, Erik Lykke, Holger Jelling Sørensen, Hans Henrik Jensen, June Machover Reinisch and Sarnoff A. Mednick. "IQ and Mental Disorder in Young Men." *British Journal of Psychiatry* 187, no 5 (2005): 407–415. <https://doi.org/10.1192/bjp.187.5.407>
- National Health and Medical Research Council. *Ethical Guidelines on the Use of Assisted Reproductive Technology in Clinical Practice and Research 2017*. National Health and Medical Research Council, 2017. <https://www.nhmrc.gov.au/art>
- National Human Genome Research Institute. "Genome-Wide Association Studies Fact Sheet." National Human Genome Research Institute, 2020. <https://www.genome.gov/about-genomics/fact-sheets/Genome-Wide-Association-Studies-Fact-Sheet>
- Nicol, Andrew, dir. *Gattaca*. Columbia Pictures. Released November 6, 1997.
- Oommen, Arun. "Factors Influencing Intelligence Quotient." *Journal of Neurology and Stroke* 1, no 4 (2014): 23–27.
- Orchid Health. "Identify Your Healthiest Embryo." Embryo Report. <https://www.orchidhealth.com/embryo>
- Oxford Dictionary of English*. Oxford: Oxford University Press, 2010.
- Parker, Michael. "The Best Possible Child." *Journal of Medical Ethics* 33, no 5 (2007): 279–283. <https://doi.org/10.1136/jme.2006.018176>
- Paul, Diane B and Hamish G Spencer. "The Hidden Science of Eugenics." *Nature* 374, no 6520 (1995): 302–304. <http://dx.doi.org/10.1038/374302a0>
- Pennings, Guido, G. de Wert, Françoise Shenfield, J. Cohen and B. Tarlatzis. "ESHRE Task Force on Ethics and Law 13: The Welfare of the Child in Medically Assisted Reproduction." *Human Reproduction* 22, no 10 (2007): 2585–2588. <https://doi.org/10.1093/humrep/dem237>
- Pereira, S., S. Carmi, G. Altarescu, J. Austin, D. Barlevy, A. Hershlag, E. Juengst, K. Kostick-Quenet, E. Kovanci, R. B. Lathi, M. Mukherjee, I. Van den Veyver, O. Zuk, G. Lázaro-Muñoz and T. Lencz. "Polygenic Embryo Screening: Four Clinical Considerations Warrant Further Attention." *Human Reproduction* 37, no 7 (2022): 1375–1378. <https://doi.org/10.1093/humrep/deac110>
- Plomin, Robert and Sophie von Stumm. "The New Genetics of Intelligence." *Nature Reviews: Genetics* 19, no 3 (2018): 148–159. <https://doi.org/10.1038/nrg.2017.104>

- Regolado, Antonio. "Eugenics 2.0: We're at the Dawn of Choosing Embryos by Health, Height and More." *MIT Technology Review*, November 1, 2017. <https://www.technologyreview.com/s/609204/eugenics-20-were-at-the-dawn-of-choosing-embryos-by-health-height-and-more/?source=download-metered-content>
- Resnik, David B. "The Moral Significance of the Therapy-Enhancement Distinction in Human Genetics." *Cambridge Quarterly of Healthcare Ethics* 9 (2000): 365–377. <https://doi.org/10.1017/s0963180100903086>
- Robertson, John A. "Procreative Liberty in the Era of Genomics." *American Journal of Law and Medicine* 29 (2003): 447. <http://dx.doi.org/10.1017/S0098858800002574>
- Sandel, Michael. *The Case Against Perfection*. Cambridge: Belknap Press, 2007.
- Savulescu, Julian. "In Defence of Procreative Beneficence." *Journal of Medical Ethics* 33, no 5 (2007): 284–288. <https://doi.org/10.1136%2Fjme.2006.018184>
- Savulescu, Julian. "Procreative Beneficence: Reasons to not have Disabled Children." In *The Sorting Society: The Ethics of Genetic Screening and Therapy*, edited by Loane Skene and Janna Thompson, 51–68. Cambridge: Cambridge University Press, 2008.
- Savulescu, Julian and Guy Kahane. "The Moral Obligation to Create Children with the Best Chance of the Best Life." *Bioethics* 23, no 5 (2009): 274–290. <https://doi.org/10.1111/j.1467-8519.2008.00687.x>
- Scott, Rosamund. "Choosing between Possible Lives: Legal and Ethical Issues in Preimplantation Genetic Diagnosis." *Oxford Journal of Legal Studies* 26, no 3 (2006): 153–178. <https://doi.org/10.1093/ojls/gqi048>
- Shulman, Carl and Nick Bostrom. "Embryo Selection for Cognitive Enhancement: Curiosity or Game-changer?" *Global Policy* 5, no 1 (2014) 85–92. <https://doi.org/10.1111/1758-5899.12123>
- Smith, Malcolm K. *Saviour Siblings and the Regulation of Assisted Reproductive Technology*. Surrey: Ashgate, 2015.
- Sparrow, Robert. "Liberalism and Eugenics." *Australasian Journal of Philosophy* 89, no 3 (2011): 499–517. <https://doi.org/10.1080/00048402.2010.484464>
- Sparrow, Robert. "A Child's Right to a Decent Future? Regulating Human Genetic Enhancement in Multicultural Societies." *Asian Bioethics Review* 4, no 4 (2012): 355–373.
- Suzuki, Lisa A., Samar Naqvi and Jill S. Hill. "Assessing Intelligence in a Cultural Context." In *APA Handbook of Multicultural Psychology: Vol. 1*, edited by Frederick T. L. Leong, 247–266. Washington: American Psychological Association, 2014.
- Taub, Gordon E. and Kevin S. McGrew. "A Confirmatory Factor Analysis of Cattell-Horn-Carroll Theory and Cross-Age Invariance of the Woodcock-Johnson Tests of Cognitive Abilities III." *School Psychology Quarterly* 19, no 1 (2004): 72–87. <http://dx.doi.org/10.1521/scpq.19.1.72.29409>
- Tellier, Laurent C. A. M., Jennifer Eccles, Nathan R. Treff, Louis Lello, Simon Fishel and Stephen Hsu. "Embryo Screening for Polygenic Disease Risk: Recent Advances and Ethical Considerations." *Genes* 12, no 8 (2021): 1105. <https://doi.org/10.3390/genes12081105>
- Treff, Nathan R., Jennifer Eccles, Lou Lello, Elan Bechor, Jeffrey Hsu, Kathryn Plunkett, Raymond Zimmerman, Bhavani Rana, Artem Samoilenko, Steven Hsu and Laurent C. A. M. Tellier. "Utility and First Clinical Application of Screening Embryos for Polygenic Disease Risk Reduction" *Frontiers in Endocrinology* (2019) 845. <https://doi.org/10.3389/fendo.2019.00845>
- Treff, Nathan R., Jennifer Eccles, Diego Marin, Edward Messick, Louis Lello, Jessalyn Gerber, Jia Xu and Laurent C. A. M. Tellier. "Preimplantation Genetic Testing for Polygenic Disease Relative Risk Reduction: Evaluation of Genomic Index Performance in 11,883 Adult Sibling Pairs." *Genes* 11, no 6 (2020): 648. <https://doi.org/10.3390/genes11060648>
- Veit, Walter, Jonathan Anomaly, Nicholas Agar, Peter Singer, Diana S Fleischman and Francesca Minerva. "Can 'Eugenics' Be Defended?" *Monash Bioethics Review* 39 (2021): 60–67. <https://doi.org/10.1007/s40592-021-00129-1>
- Wilkinson, Stephen. *Choosing Tomorrow's Children: The Ethics of Selective Reproduction*. Oxford University Press, 2010.
- Wilkinson, Stephen. "'Eugenics Talk' and the Language of Bioethics." *Journal of Medical Ethics* 34 (2008): 467–471. <http://dx.doi.org/10.1136/jme.2007.021592>
- Wilson, Clare. "A New Test Can Predict IVF Embryos' Risk of Having a Low IQ." *New Scientist*, November 18, 2018. <https://www.newscientist.com/article/mg24032041-900-exclusive-a-new-test-can-predict-ivf-embryos-risk-of-having-a-low-iq/>
- Wilson, Robert A. "Eugenics Undefended." *Monash Bioethics Review* 37 (2019): 68–75. <http://dx.doi.org/10.1007/s40592-019-00094-w>
- Zagorsky, Jay L. "Do you have to be Smart to be Rich? The Impact of IQ on Wealth, Income and Financial Distress." *Intelligence* 35 no 5 (2007): 489–501.

Primary Sources

- 1907 Indiana Eugenics Law, Ind Code ch 215.
 Assisted Reproductive Treatment Act 1988 (SA).
 Assisted Reproductive Treatment Act 2008 (Vic).

Human Reproductive Technology Act 1991 (WA).
Marion's Case (1992) 175 CLR 218.
Wisconsin v Yoder 406 US 205 (1972).