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From Self-Determination to Offspring-Determination? Reproductive Autonomy, Procrustean Parenting, and Genetic Enhancement

by

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Abstract: Emerging reprogenetic technologies may radically change how humans reproduce in the not-so-distant future. One foreseeable consequence of disruptive innovations in the procreative domain is an increase in the reproductive autonomy of intended parents. Regarding the prospective parental liberty of enhancing non-health–related traits of the offspring, one controversy has particularly dominated the literature. Does parents' choice of genetically enhancing the traits of their descendants compromise children's future personal autonomy? In this article, I will analyse the main arguments which posit that reprogenetic enhancement could be at odds with the child's future autonomy. I will argue that these objections are ill-founded. Moreover, I will present other arguments that show that reprogenetic technologies can enhance the autonomy of future children. Autonomy enhancement is a plausible and *pro tanto* desirable application of emerging reprogenetic technologies.

Keywords: autonomy, autonomy enhancement, reprogenetic technologies, GenEthics, genetic enhancement, reproductive autonomy

1. Introduction

One of Thomas' aspirations was becoming a violin virtuoso. Years of long, hard training at the conservatoire never fully compensated for his modest natural talent for music. He never became more than an amateur violinist.

Hannah was a mediocre athlete. She competed at regional levels until she was a quarter of a century old, when she decided to quit due to lack of motivation. She realized that, despite her best efforts, she would never be able to come close to the top. Although Hannah could not complain about her physique, she did not have the endowment to be one of the best on the track.

Thomas and Hannah are in love and want to have children together. Like most parents, they want the best possible life for their offspring. In fact, they would like their children to have the opportunity to achieve their dreams and not to be frustrated in their aspirations to be, for instance, musicians or athletes. For these reasons, Thomas and Hannah have decided to go to the Morpheus Clinic. This clinic offers assisted reproduction services so that parents can have babies with the genetic endowment they lacked to achieve their dreams. Thomas and Hannah do not have, to their knowledge, fertility problems. But they know that if they conceived by sexual intercourse the baby would be the result of a random combination of their genes. In the Morpheus Clinic, Thomas and Hannah will pay for a customized genetic package that includes the prevention of serious genetic diseases and the enhancement of various genetic traits. Among these traits, they have included not only generally valued characteristics, such as good memory, enhanced general cognitive abilities, or less predisposition to develop addictive behaviours, but also genes that facilitate musical talent or athletic performance. Who knows, after all, whether their children will become renowned musicians or athletes in the future?

What (if anything) is morally suspicious in the case of Thomas and Hannah? Humans have influenced their progeny's traits since the dawn of our species. The selection of the sexual mate gives likely clues about the traits that the offspring may inherit (Gyngell, 2019). Maternal nutrition, the timing of pregnancies, or techniques such as embryonic screening are actions that influence the characteristics of the child that is coming into existence (Bostrom and Ord, 2006, p. 679). Admittedly, contemporary prenatal reproductive practices have a limited scope in influencing the traits of the progeny. The case of Thomas and Hannah, on the contrary, shows a scenario in which the proactive selection and enhancement of specific hereditary traits by biotechnological means is part of parents' reproductive autonomy. Needless to say, we are not currently in that scenario. Disruptive innovations on reproductive genetic technologies, however, invite us to anticipate that reproductive autonomy may expand considerably in the (not so distant) future. In that case, the ability to influence the traits of our descendants could be qualitatively different from what has been possible during the history of humanity.[1] The last two decades in the genetic enhancement debate, in fact, show that there are novel ethical questions to be addressed in this regard.

In this article, I will focus on a particular controversy. The dispute is whether the freedom of parents to genetically enhance their children can be at odds with their children's future freedom. In other words, could genetic enhancement based on parental reproductive autonomy erode the personal autonomy of the future child? Or, in short, is reprogenetic enhancement a sort of procrustean parenting? This is a very legitimate concern that may cast doubt about the ethical desirability of reprogenetic enhancement projects. Not coincidentally, the most conspicuous opponents to genetic enhancement have based some of their criticism on this peril. Genetic enhancement can challenge the self-authorship component of autonomy (Habermas, 2003), and genetic modifications can leave irremovable characteristics in children and their subsequent descendants (Fukuyama, 2002, p. 94).

1 I thank one of the reviewers for this comment. Brock (2005) also argued that reprogenetic technologies may produce changes of degree and of means about the possibilities of shaping future offspring.

Genetic technologies can also be used by parents such as Thomas and Hannah to place their expectations on the selected and enhanced traits of their children (President's Council on Bioethics, 2003, pp. 49–54). The drive to master the mystery of birth, moreover, is an example of hyper-parenting that may distort the foundations of virtuous parenthood (Sandel, 2007, p. 46).

That said, the aim of my article is twofold. To begin with, I will dismiss the understanding of genetic enhancement as procrustean parenting. After that, I will not only show that that approach is misleading but also that reprogenetic technologies[2] may actually improve the prospective personal autonomy of enhanced children. To meet both goals, the structure of my argument will be the following. In the second section, I will clarify the concept of reproductive autonomy, and I will briefly sketch the landscape of emerging reproductive genetic technologies that may lead to genetic enhancement. In the third section, I will advance the most relevant concerns that point out that genetic enhancement could be at odds with the child's future autonomy. I argue that none of these arguments is strong enough to satisfactorily hold that claim. In the fourth section, I will develop four arguments that show that autonomy enhancement through reprogenetic technologies is plausible and normatively desirable. To conclude, it is reasonable to think that reproductive autonomy can be stretched by the development of emerging genetic technologies. Even if these advances make human genetic enhancement possible shortly, it will neither leave inevitably to procrustean parenting nor will the future freedom of the children necessarily be diminished; in fact, it seems that it could be improved.

2. Reproductive Autonomy and Emerging Reprogenetic Technologies

Reproductive autonomy or procreative liberty[3] is the freedom to decide whether to have offspring (Robertson, 1994, p. 4). Humans have control over their reproductive autonomy when they decide with whom to reproduce, when, and how many times. In the last 40 years, the scope of reproductive autonomy has been expanded due to technological assistance. Reprogenetic technologies offer an unprecedented degree of control in reproductive matters (de Melo-Martín, 2017, p. 54). Although this level of reproductive control is by now limited, some

2 *Reprogenetic technologies* are technologies that include reproductive and genetic tools (de Melo-Martín, 2017).

3 For simplicity, I will use the concepts of *procreative liberty* and *reproductive autonomy* interchangeably. However, it could be said that they have different philosophical nuances. Liberty is often understood as freedom from non-interference in the Millean sense (Mill, 1859/1909), whereas autonomy is often referred to in its Kantian rationalist roots (Kant, 1785/2011). See Véliz et al. (2019) for a recent analysis of the conceptual differences between liberty, freedom of choice, and autonomy.

biotechnological advances may substantially broaden the scope of procreative decisions, enabling genetic enhancement of future offspring. In what follows, I will briefly introduce the main reproductive genetic technologies, that is, the technologies that allow parents to reproduce themselves and to influence the genetic makeup of their children (Gyngell, 2019). I will only focus on the technologies that have greater potential for genetic enhancement in the reproductive domain.

2.1 Assisted reproductive technologies

Assisted reproductive technologies (ARTs) basically aim to create viable embryos and to implant them to create a pregnancy. Embryos are created through in vitro fertilization (IVF). IVF is the insemination of harvested eggs with sperm. These human gametes (eggs and sperms) can be collected from prospective parents or donors.[4] Then, one or various embryos are transferred to the woman's uterus in a maximum of six days after fertilization. Although implanting the embryo(s) is not a guarantee of pregnancy, this procedure has become a helpful aid for people with low fertility and for those who could not reproduce otherwise, providing novel procreation opportunities to infertile individuals, single women, same-sex couples, or people at risk of transmitting genetic diseases to their children. ARTs are also the baseline of future reprogenetic enhancement because they would rely on IVF and in the subsequent genetic screening and/or editing of the available embryos. For that, having genetic information before pregnancy may not only be crucial to avoid the transmission of inheritable disorders but also to select and improve heritable traits beyond health purposes.

2.2 Preimplantation genetic diagnosis for embryo selection

Preimplantation genetic diagnosis (PGD) is a test performed in assisted reproduction procedures that currently allows detecting genetic diseases, chromosomal abnormalities, or the sex of the embryo. PGD is the quintessential reprogenetic technology for embryo screening and selective implantation. Admittedly, its reputation is due to the prevention of genetic and chromosomal diseases because it can provide crucial information, testing a range of approximately 200 conditions (de Melo-Martín, 2017, p. 44), to select the unaffected embryo before the uterine transfer. PGD may enable soon to know a variety of non-health–related traits of

4 In fertility clinics, gamete donor selection sometimes implies opting for some specific genetic traits for the offspring. The sperm and egg market often advertise the characteristics of the gamete "donors" available in the biobanks. The sperm or egg selection commonly involves gamete screening, namely, selecting the gamete donor based on heritable genetic characteristics (Gyngell, 2019). For instance, a controversial patent was granted to the famous direct-to-consumer genetics company 23andMe for "gamete donor selection based on genetic calculations" from the genotypic information of the donors and their combinations with the recipients (DeFrancesco, 2014).

the analysed embryo and, by consequence, of the hypothetical future person. Next-generation sequencing allows predicting the likelihood of developing phenotypic characteristics that are strongly genetically influenced. In particular, comprehensive genetic testing (e.g., whole genome sequencing or microarrays) will shortly be able to give information about non-health–related traits of the examined embryos. Those "non-medical traits would include things like sex, physical characteristics (height, build, hair color, eye color, etc.), temperaments (tendencies toward extroversion, introversion, anxiety, etc.), and capacities in areas such as athletics, scholastics, music, etc." (Suter, 2018, p. 268).

The possibility of selecting complex traits, however, is still distant. Most desired complex traits (e.g., intelligence, height, or empathy) that are based partly on genetic contribution are influenced by several (sometimes hundreds of) genes and also diverse environmental factors. Yet, the knowledge gap between particular genotypes and complex phenotypic traits may be shortened through genome-wide association studies. Machine learning is advancing genomic studies by providing information about what particular genes do and also how they interact to shape complex polygenic traits (Anomaly, 2020, p. 8). We could have a *polygenic score*, namely, an estimation of the probability of developing complex traits that are the result of the interplay between large numbers of genes (Greely, 2016; Anomaly, 2020). Going back to the example of the introduction, intended parents such as Thomas and Hannah could select the embryos that have the greatest chance of developing talents that are largely genetically influenced like musical ability (Oikkonen et al., 2015) or athletic performance (Rice, 2013). Still, PGD faces the problem that currently IVF procedures only produce a limited number of embryos, normally around four. Thus, the reproductive choice through PDG is quite limited in the absence of other technologies.

2.3 In vitro gametogenesis

In vitro gametogenesis (IVG) refers to the artificial production of gametes in the lab from other cell types. It allows deriving oocytes and sperm in a culture dish from somatic cells. IVG is a disruptive technology that may bring major transformations in reproductive and regenerative medicine (Cohen et al., 2017). Although this procedure is still in the experimental phase, one day it may be used for reproductive purposes in humans (Notini et al., 2020), raising at least three relevant promises. First, this technology offers new options for establishing genetic parenthood. IVG would enable opposite-sex couples suffering from infertility, post-menopausal women, same-sex couples (lesbians could create sperm, and gay males could generate eggs), and single individuals — with or without the genetic contribution of another individual (the latter is known as *solo reproduction*, see Cutas and Smajdor, 2017) — to have biologically related offspring (Notini et al., 2020). It could also facilitate "multiplex" parenting in which more than two genetic parents are involved (Palacios-González et al., 2014). Second, it would make ART procedures safer and more comfortable for women. IVG would overcome the considerable psychological, economic, and health costs of ovarian stimulation and oocyte retrieval of current assisted reproduction. Third, and more importantly for genetic enhancement debate, the creation of artificial gametes for IVF may elevate the total number of available embryos for PGD and for the subsequent selective implantation.

2.4 CRISPR-Cas9 genome editing

CRISPR (clustered regularly interspaced short palindromic repeats) is nowadays the most promising genome editing technique. The diversity, modularity, and efficacy of the CRISPR-Cas9 toolkit enable enormous clinical and agricultural breakthroughs, making it the leader of the future of precision genome engineering (Knott and Doudna, 2018). In 2012, CRISPR was hypothesized to be a simple and versatile gene editor (Jinek et al., 2012). In 2015, the first modifications using this technique were made in early human embryos (Liang et al., 2015). In October 2018, the first genome-edited human babies — the twin girls known under the pseudonyms Lulu and Nana — were born in China after the infamous experiment lead by He Jiankui (Regalado, 2018), which was strongly condemned by the international scientific and bioethical community (Cyranoski, 2018; Cyranoski and Ledford, 2018; Savulescu and Singer, 2019).

CRISPR can produce heritable changes by modifying the human germline. Unlike somatic cell gene interventions, whose changes remain only in the modified individual, genetic modifications in germ cells (i.e., sexual gametes and embryos) persist throughout the life of the modified individual and are transmitted to the offspring and future generations. The most promising clinical application of CRISPR in embryos is the prevention of some serious genetic diseases by correcting single-gene disorders (e.g., Tay-Sachs, Huntington's disease, cystic fibrosis, or sickle cell anaemia) that have straightforward inheritance patterns (recessive or dominant) with a maximum penetrance, up to 99% probability of expressing them in some cases.[5] Moreover, germline editing in principle can act against polygenic diseases. Most common conditions such as cancer, diabetes, or coronary artery disease depend on several genes and their interaction with the environment, and/or with individual lifestyles. Germline gene editing could

5 However, it is uncertain when CRISPR will be completely safe to eliminate those single-gene disorders. This technology is still in the experimental phase and has provoked negative consequences in clinical trials with embryos, producing off-target mutations (changing non-targeted genes) and mosaicism (when all cells have not the same genome) (see Ranisch, 2020, p. 61n6).

reduce the risk of having polygenic diseases simultaneously targeting many different genes, something that is difficult (or impossible) to accomplish through PGD (Gyngell et al., 2017, pp. 501–502).[6] The possibility of multi-targeting would also allow the enhancement of polygenic traits. Furthermore, CRISPR is a tool that not only permits the modication or deletion of existing genes but also the insertion of new ones. In principle, it can raise the possibility of rewriting human DNA sequences to improve non-health–related genetic traits.

3. Procrustean Parenting and Offspring Determination

Reprogenetic technologies do not only involve the procreative autonomy of intended parents but also affect the nature of the person that is coming into existence (Buchanan et al., 2000, p. 218; Brock, 2005; Glover, 2006; Liao, 2019). Choosing the sort of people that will be born raises several concerns. In this section, I will focus on the so-called procrustean parenting argumentation (Lewens, 2009, 2015). Under that label, I will analyse different, although related, objections to genetic enhancement. They have in common the concern regarding the fact that parental choice of genetically enhancing the future child could threaten the child's prospective autonomous life. I will show that none of these objections is strong enough to claim that genetic enhancement compromises the freedom or autonomy of the future child.

3.1 The genetic tattoo

Genetic engineering in humans has raised several concerns for decades. Now CRISPR permits editing the human genetic germline. However, before the development of this tool, a major criticism of this possibility had already been made. According to Francis Fukuyama,

> (g)enetic modification is more likely giving your child a tattoo that she can never subsequently remove and will have to hand down not just to her own children but to all subsequent descendants. (Fukuyama, 2002, p. 94)

Fukuyama is there concerned with two problems: one about parental contingent preferences and the other about the irreversibility of genetic germline modifications. Despite appearing to be seemingly advantageous reproductive choices, parental decisions regarding genetic engineering can harm children due to certain cultural and historical biases. For instance, aesthetic preferences (e.g., slim women) change over time and from generation to generation. Allowing parents to

6 An interesting debate which is unfortunately beyond the scope of this paper is whether PGD could be replaced or complemented by genome editing (see Cavaliere, 2018; Rodríguez López, 2019; de Araujo, 2020; Ranisch, 2020).

choose traits based on this type of contingent preferences can lead to irreversible changes in offspring. On the other hand, if the *genetic tattoo* cannot be removed, genetic modifications will be irremediably transmitted to future generations. Therefore, the irreversibility of germline interventions and their possible foundation on contingent parental preferences make genetic enhancement ethically worrisome.

Both concerns are relevant, but neither is insurmountable. I will raise three objections to the *genetic tattoo argument*. First, the range of genetic enhancement interventions could be limited to prevent passing whims of parents from influencing the genetic choice of controversial traits for their offspring. For instance, the selection of aesthetic traits could be forbidden, whereas enhancing other traits (whose preference is less volatile) could be allowed.[7] In the fourth section, I will mention some of these general-purpose goods whose social appreciation is less likely to change over time.

Second, the fact that germline gene editing affects future generations is of prime importance. Habermas (2003, pp. 63–65) is also concerned about the irreversible character of eugenic choices. He claims that there is an intergenerational moral asymmetry between parents and children in this regard: genetic germline modification is a one-sided act that is performed without the consent of the future recipients. I agree with this latter claim. However, from there it does not follow that irreversibility is always a bad thing. *Irreversibly* eliminating a devastating genetic disease such as Tay-Sach is ethically desirable. Moreover, irreversibility is less worrisome when the technique proves to be safe, without leading to unintended off-target effects, and when the preferences behind the genetic choice are well founded and exclude contingent desires.

Third, the premise that germline genetic interventions are irreversible is not entirely accurate. In principle, germline modifications can be reversed by other germline modifications (Lewens, 2020). More speculatively, they could be reversed by somatic gene therapy or by medical nanotechnology (Bostrom, 2003, p. 504). Future generations will probably have better technologies to remake the inherited germ-line changes than we currently do. In addition, not only could they reverse the germline modifications caused by genome editing but also address those that are the result of epigenetic inheritance.[8]

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7 To make this claim, I am taking for granted that aesthetic preferences (e.g., about the physical traits that conform to human beauty) are more volatile than non-aesthetic preferences. This is of course contestable, particularly if one takes an approach to beauty based on evolutionary perspectives. See Anomaly (2020, chapter 3) for the debate about creating pretty people.

8 Tim Lewens (2020) has recently addressed the issue of transgenerational epigenetic inheritance. According to him, in bioethical circles "germline inheritance" has been the principal focus, neglecting the importance of non-genetic inheritances like epigenetic inheritance.

3.2 Autonomy as self-authorship

Jürgen Habermas offered a sophisticated critique against genetic enhancement in his book *The Future of Human Nature* (Habermas, 2003). He argued that prenatal genetic enhancement could be inimical to the autonomy of the future child. From the Habermasean perspective, "parents' eugenic freedom" could "enter into collision with the ethical freedom of their children" (p. 49). Consider, moreover, the following often-quoted fragment:

> Eugenic interventions aiming at enhancement reduce ethical freedom insofar as they tie down the person concerned to rejected, but irreversible intentions of a third party, barring him from the spontaneous self-perception of being the undivided author of his own life. (Habermas, 2003, p. 63)

Call this the *argument from self-authorship*.[9] The basic claim is that genetic enhancement could menace the self-conception of the future child as the author of her own life. Habermas grounded his argument in the distinction between the grown and the made. A nature-like grown person needs to be distinguished from a technically made (or a genetically programmed) person (p. 42). The former is a *person born*, the latter a *person made* (p. 65). The capacity of being oneself is eroded by the fact of being prenatally manufactured. When the genetically enhanced adolescent knows that she has been designed, the revisionary self-understanding of her personal identity is disrupted. She will perceive herself as a person *made*, which can undermine the self-direction component needed to conduct an autonomous life. This only happens, moreover, with genetic enhancement interventions but not therapeutic ones. A genetic therapeutic modification can be preemptively accepted by the anticipated and counterfactual consent of the future person (p. 43). On the other hand, Habermas acknowledged that personal identity is developed by influences that condition self-authorship. After childbirth, natality concludes the natural fate and inaugurates the social fate. The self is a product of socialization. Socialization shapes the identity of the individual, however, in the communicative relationship that respects autonomy formation in contrast to prenatal genetic enhancement.

The attractiveness of this objection decreases if one is committed neither to the distinction between treatment and enhancement nor to the distinction between genetic and environmental intervention, not to mention the Habermasean metaphysical conception of the self which oscillates between the grown and the made. For Habermas, those distinctions have moral relevance (Pugh, 2015) and overlap in the case of genetic enhancement. However, relying on those blurred

9 Pugh (2015) called this argument the "argument from natality" and Schaefer et al. (2014, pp. 132–135) called it the "communicative objection." Although Arendt's approach to natality plays a significant role in this argument, as well as Habermas' communicative ethics background is present in it, I think that it could be better and more simply conceived as the "argument from self-authorship."

distinctions is misleading due to at least two reasons. First, prenatal environmental factors already impact the development of the future child. While the fetus is in the womb, the mother's diet or activities such as playing music can influence the child's future existence; more importantly, those environmental practices can prenatally *enhance* the person-to-be (Pugh, 2015, p. 150).

Second, if what is at stake is the self-authorship component of personal identity, treating some genetic condition or chromosomal abnormalities can be more disruptive than enhancement. For instance, performing genome editing to avoid the conception of a deaf or a Down's syndrome child could, if possible, certainly have more identity-affecting changes for the future person. Habermas would argue that these "treatments" — for some, deafness is not a disability at all — can be counterfactually accepted by the future child, in contrast to enhancement interventions. But this is assuming too much. Hypothetically, the enhanced adolescent could thank her parents for bringing her into the world without serious illnesses or disabilities and with an improved set of talents, even if she does not develop all of them. This is even clearer if the enhanced traits are linked to those that are necessary to be an autonomous agent (see the fourth section), making applicable the anticipated consent of the future child (Schaefer et al., 2014, p. 133). In this sense, if autonomy is understood as a capacity, and if parental choices enhance the traits necessary to be autonomous, the Habermasean criticism loses its force (Malmqvist, 2007, pp. 408–409).

3.3 Hyper-parenting

Michael Sandel (2007) criticised reprogenetic enhancement on the grounds that it could distort virtuous parenthood. Consider the next passage:

> [T]he deepest moral objection to enhancement lies less in the perfection it seeks than in the human disposition it expresses and promotes. The problem is not that the parents usurp the autonomy of the child they design. (It is not as if the child could otherwise choose her genetic traits for herself.) The problem lies in the hubris of the designing parents, in their drive to master the mystery of birth. Even if this disposition does not make parents tyrants to their children, it disfigures the relation between parent and child, and deprives the parent of the humility and enlarged human sympathies that an openness to the unbidden can cultivate. (Sandel, 2007, p. 46)

This is an interesting argument because it primarily focuses on parenting and secondarily focuses on future children's autonomy. The main problem at stake is the relationship that could be established between prospective parents and enhanced children. This relationship can affect the future autonomy of the children but only to the extent that genetic enhancement changes the manner parents raise their children, and this in turn influences the future life of the genetically enhanced children. The objection that Sandel raised in this context is that of *hyper-parenting*. Sandel diagnoses a set of parental practices in child-rearing based on high-pressure activities that shape the future flourishing of children. For instance, "overly ambitious parents" try to improve the performance of their children "by enrolling them in expensive schools, hiring private tutors, sending them to tennis camp, providing them with piano lessons, ballet lessons, swimming lessons, SAT prep courses, and so on" (pp. 50–51). Genetic enhancement can therefore exacerbate this hyper-parenting trend until it becomes another added pressure, particularly in the prenatal domain. Sandel defends an ethics of giftedness from which genetic enhancement is genuinely worrisome because it can foster human dispositions that are vicious (drive to mastery and hubris) while eroding those that are virtuous (humility, respect for the given, openness to the unbidden, unconditional parental love, and acceptance).

Sandel's diagnosis is largely correct, but the consequences he draws from it are not entirely convincing. Needless to say, hyper-parenting is a growing practice that should be avoided, especially when it diminishes the child's right to an open future, as we will see in the fourth section. The main problem with Sandel's argument is that it conflates enhancement with hyper-parenting (Savulescu, 2019, pp. 324–325). From the fact that hyper-parenting is undesirable, it does not follow that genetic enhancement in itself is undesirable. Enhancement would be undesirable only in those times when it fulfils the same requirements that make hyper-parenting undesirable. Furthermore, why does genetic enhancement have to be at odds with the values of the ethics of giftedness such as humility or unconditional parental love?[10] Those values, moreover, are not uncontroversial, and we do not have to accept them all. For example, a categorical *respect for the given* could be inimical to biomedical practice when it tries to eliminate congenital diseases, mastering precisely the mystery of the birth. In that case, we actually have strong ethical reasons to interfere in the given.

3.4 Parental expectations

Thomas and Hannah have selected a set of traits for their future child. They have paid the clinic to increase the likelihood that their child will have musical and athletic abilities. Thomas and Hannah have a reasonable expectation that their child could excel in sports and music. In fact, this expectation is more likely to be met if they support their child in developing these skills during their parenting. For some, this prospect is worrisome. Reprogenetic enhancement may increase

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10 Regarding parental love, Nick Bostrom said that "(w)e might speculate, instead, that germ-line enhancements will lead to more love and parental dedication. Some mothers and fathers might find it easier to love a child who, thanks to enhancements, is bright, beautiful, healthy, and happy" (Bostrom, 2003, p. 498). However, even if that intuition suggested by Bostrom is plausible, Sandel could still argue that that would not constitute a case of virtuous parental love inasmuch it is conditioned to the characteristics possessed by the child. I thank one of the reviewers for pushing me to this point.

parental expectations to the point of making them over-demanding for the future child. Parental expectations can exert undue pressure, excessively influencing the development of the child's personality and aspirations in such a way that their future autonomous life plans are restricted.

Although this kind of argumentation is pervasive in literature, let us consider first one of its most powerful manifestations:

> [T]he "better" child may bear the burden of living up to the standards he was "designed" to meet. The oppressive weight of his parents' expectations — resting in this case on what they believe to be undeniable biological facts — may impinge upon the child's freedom to make his own way in the world. Here we see one of the ethically paradoxical consequences of the new screening technologies: designed to free us from the tyranny of our genes, they may end up narrowing our freedoms as individuals even further. (President's Council on Bioethics, 2003, pp. 53–54)

Call this the *argument from parental expectations*. In my opinion, this is the most powerful *procrustean parenting*-type objection about diminishing children's future autonomy. In what follows, I will clarify the most relevant components of this argument: (*i*) instrumentalization, (*ii*) the investment factor, and (iii) the empirical ground. Then, I will claim that to weaken the force of this objection, some caveats should be highlighted in reprogenetic enhancement services.

First, parents can expect different things from their children. One thing parents can hope for is that their children will fulfil the dreams they were unable to realize. Reprogenetic enhancement can give children the genetic contribution necessary to develop specific traits beyond the normal range. Suppose that one of the children of Thomas and Hannah finally has an outstanding genetic endowment to excel in sports. This "natural" talent has been developed considerably during her childhood due to intense training in swimming. Suppose, furthermore, that when she is a young adult, she wants to quit competing in swimming, even though she is one the best in her country according to her age. She no longer wants to expend her time in the pool but rather prefers to invest her time in painting at home in preparation for her admission to fine arts school. This is very disappointing to her parents, especially to her mother Hannah, who wanted her daughter to be a professional sportsperson. According to Habermas (2003, p. 61), this would constitute a *dissonant case*, that is, a situation in which the enhanced person does not want to develop the skills that were bestowed upon her to carry out a possible life plan that her parents valued. Here comes out the first component of the argument from parental expectations: the peril of *instrumentalization*. Habermas, Sandel, and the President's Council on Bioethics fear that genetically enhanced children can become the means for the (unaccomplished) ends of their parents. If enhanced children would primarily pursue their parents' goals rather than their own, they would certainly be less autonomous.

The second element is the *investment factor*. Let me mention a truism: parents spend considerable time and money on their children. Moreover, parental expectations can be influenced by the number of resources invested on one child. In fact, it is possible to argue that the more money and time invested in a child, the more will be expected from her. For instance, the more resources parents invest in private piano and solfeggio lessons, as well as conservatoire, the more the future child will be expected to develop great musical skills. Because reprogenetic enhancement could require considerable (economic) investment, enhanced children can feel excessive pressure to develop the capacities that their parents paid for (Davis, 2009; Pugh, 2015, p. 152). This possible undue influence could restrict the freedom of enhanced children to opt for particular life projects and, more specifically, to reject those in which parents have invested more resources.

The third characteristic of the argument of parental expectations is that it is ultimately an *empirical matter*. It depends particularly on empirical psychological premises (Malmqvist, 2007). Actually, when Pugh (2015) referred to the Habermasean approach to parental expectations, he called it *the empirical argument*. This empirical dimension makes the argument of parental expectation an objection that is quite uncertain and would require further factual validation. Even if enhanced children incarnated the talents that their parents have dreamed of, it is difficult to know how parental expectations would psychologically affect them. From a strong view, having enhanced genetic capabilities can *directly* influence the choices our descendants make. From a weak view, genetic enhancements can *indirectly* affect children, subtlety impacting the psychological grounding of their life decisions (Malmqvist, 2007, p. 409). On the other hand, enhanced adolescents can surely refuse to develop those talents that were deliberately selected/edited for them in the reproduction clinic. In this respect, we can state that it is easier for dissonant cases to occur when only very specific traits are selected and enhanced. This is more difficult to happen with general purpose means, as we will see in the next section.

Having addressed those three characteristics, it seems clear why we should take this objection seriously. Still, these three characteristics do not make the argument of parental expectation unsurmountable. The main point is that it is difficult to state that parental expectations are substantially stronger in the case of genetic enhancement than in other ordinary cases. Do not parents who educate their children to inherit the family business (a restaurant or grocery store) instrumentalize their children in some way? Does not paying a child to attend a very expensive business school to inherit the family firm also imply a very elevated investment factor? Even assuming that genetic enhancement is more expensive than a private university, does this make parental expectations created by the former and the latter different in kind rather than in degree? I find it difficult to affirm the latter.

As with the argument of hyper-parenting, this objection tries to see genetic enhancement as something more problematic than other existent social practices. And in the absence of persuasive arguments to claim it, that is begging the question.

Finally, I think that this is the most interesting objection because it obliges us to anticipate a practical requirement. Reprogenetic enhancement services *should not* promote unrealistic expectations about enhanced children in intended parents. In that scenario, genetic counsellors should communicate clearly without creating false expectations. Genetic exceptionalism and genetic determinism should be straightforwardly avoided in the enhancement clinic. From the heritability of a trait, it does not follow the inalterability of a character (Buchanan et al., 2000, p. 317). Moreover, in most cases, parents will select for a predisposition because most desired phenotypic traits depend on the gene–environment interaction (Malmqvist, 2014, p. 48). These facts should be clearly transmitted to the prospective parents to avoid unreasonable expectations of their children's skills. Genetic enhancement would neither fix the future personal identity nor the capabilities that have been improved.

Thus, the creation of parental expectations is not a unique problem for genetic enhancement. Unreasonable expectations can not only be appeased, but we *must* also anticipate and mitigate them.

4. Autonomy Enhancement Through Reprogenetic Technologies

Parents generally want their children to be born healthy. They commonly make reproductive choices to avoid genetic diseases in part because health is "autonomy conductive" and because illness is "autonomy inhibiting" (Malmqvist, 2014, p. 46). Still, health is not the only factor that enables a minimum autonomous life. In this section, I shall delineate the prospects of using reprogenetic technologies to enhance traits beyond health purposes in order to improve children's future autonomy. Here I use *autonomy enhancement* as a multifaceted term that encompasses various views about the improvement of different aspects regarding human autonomy, positive freedom, or freedom of choice. Of course, all of these conceptions that I shall approach have diverse philosophical nuances and come from different backgrounds. However, all of them lead us to envision that genetic enhancement has the potential to improve relevant aspects related to the autonomy and positive freedom of future offspring.

I will address four different but not completely unrelated issues: (*a*) child's right to an open future, (*b*) general purpose means, (*c*) the capability approach, and (*d*) procedural autonomy. By doing this I intend to clarify different plausible ways in which reprogenetic technologies could enhance autonomy. These four are different conceptions in which reprogenetics could (*a*) enhance future adult person's freedom of choice, (*b*) enhance the traits which are generally desirable in order to develop almost any possible kind of life plan, (*c*) improve the capabilities that give the substantive freedom for beings and doings that people may have reason to value, and (*d*) enhance the basis that underlies the procedural capabilities needed for a rational and critical self-reflection on personal life projects. Overall, these four aspects not only portray the possibility of autonomy enhancement through reprogenetic technologies but also give normative reasons about its *pro tanto* desirability.

4.1 A child's right to an open future

The *child's right to an open future* was postulated by Joel Feinberg (1980/1992) in the context of childrearing and (religious) education. This formula refers to the child's right "to have these future options kept open until he is fully formed, self-determinating adult capable of deciding among them" (Feinberg, 1980/1992, p. 77). This is a pervasive topic in reproductive ethics literature and has relevant implications in the genetic enhancement debate. On the one hand, this argument has been used to object to some kind of genetic choice. For instance, Dena Davis (1997) claimed that proactively selecting a deaf child would limit the future life plans of that individual and would, consequently, violate the child's right to an open future. That would constitute a case of *designer disability* (Savulescu, 2002). On a very intuitive level, it seems evident that a deaf child has *prima facie* a more limited range of life options than a hearing child. Thus, using this argument against designer disabilities seems correct.

More surprisingly, Davis (2009) also stated that genetic *enhancement* could go against the child's open future. There are two reasons why I have not analysed this argument as an objection to genetic enhancement in the previous section. First, Davis (2009) relied mainly on a version of the argument of parental expectations — particularly on the investment factor — that I have extensively analysed earlier. Second, it is highly implausible in the case of *autonomy* enhancement. As Schaefer, Kahane, and Savulescu have rightly pointed in this respect,

> [B]eing autonomous is integral to taking full advantage of various options; enhancing autonomy should directly promote the number and value of a child's options, not restrict them. Even if increased autonomy remove a handful of options (such as joining a community that disvalues autonomy) from the menu, many more will be opened up (more career opportunities, better management of resources to obtain what one wants, and even greater ability to discern how to integrate into a wide variety of communities, etc.). (Schaefer et al., 2014, p. 131)

Admittedly, when making genetic choices, an open future is something that we owe to our descendants (Glover, 2006, p. 104). The selected or edited capabilities should not be at odds with future adult person's autonomy, nor should they restrict significant life options. To guarantee an open future for children, parents should particularly not endanger their prospective freedom of choice (Malmqvist, 2007, pp. 409–410). But it is difficult to find cases in which genetic enhancement (not to mention autonomy enhancement through genetic technologies) could menace the child's open future. Rather, I think that there are three reasons to claim quite the opposite, namely, that reprogenetic enhancement can maximize the child's right to an open future. First, enhancing general purpose goods could facilitate pursuing more future options (Malmqvist, 2009), as we will see below. Second, the procedural abilities to make more reflective choices could also be enhanced, as we will see in the last part of this fourth section. Third, genetic enhancement can increase rather than decrease the range of opportunities of the genetically enhanced person (Buchanan et al., 2000, pp. 170–172; Agar, 2004, pp. 121–124; Lewens, 2015, pp. 202–203). For instance, Bostrom said that "[b]eing healthy, smarter, having a wide range of talents, or possessing greater powers of self-control are blessings that tend to open more life paths than they block" (Bostrom, 2005, p. 212).

In short, genetic enhancement generally opens more life options than it closes. Moreover, having an open future is in the child's best interests (Brock, 2005, p. 385). The principle of the best interests of the child would require therefore to value the prospects of autonomy enhancement in procreative decisions.

4.2 General purpose means

General purpose means (GPM)[11] are those capabilities that are "useful and valuable in carrying out nearly any plan of life or set of aims that humans typically have" (Buchanan et al., 2000, p. 167). The common idea is that some abilities are valuable to realize almost any kind of virtual life plan. The most mentioned GPM are the following: intelligence, sight, hearing, good memory, long attention span, social abilities, self-discipline, foresight, patience, sense of humour, or optimism (Buchanan et al., 2000, pp. 167–170; Savulescu, 2006, p. 333; Lewens, 2009, p. 356; Pugh, 2015, pp. 150–151). Surely, the list of GPM may seem narrow. Some of these candidates could appear controversial in some extraordinary dissonant cases. And more importantly, the genetic contribution of some of those traits needs further research. However, one of the greatest appeals of GPM is that they

11 This same concept has received other names, such as "multipurpose traits" (Malmqvist, 2007, p. 415n5), or "all purpose means" (Savulescu, 2006, p. 333), and is analogous to what John Rawls called "natural primary goods" (Rawls, 1971/1999, p. 54; see Buchanan et al., 2000, p. 174). GPM can be considered particularly important in liberal and pluralistic societies, where it is legitimate for individuals to have different life plans. Still, the diversity of goals does not necessarily imply the same diversity of means. Having many of these capabilities is desirable regardless of one's particular life project. Or more precisely, some traits are valuable actually because they are useful to lead a wide variety of life plans.

largely open more future options than they close for future children (Malmqvist, 2009). Because GPM have great utility in a wide range of rational life projects, enhancing them would certainly benefit the future child (Pugh, 2015, p. 151).

Finally, I would like to point out one advantage of GPM. The advantage is that most of these traits are less vulnerable to the objection of *positional goods*. Positional goods are those that benefit the owner in relation to other people; that is, these goods depend on the extent that other people do *not* have them or have them to a lesser extent. A paradigmatic example is height. One is "tall" or "short" only in relation to others. Enhancing positional goods in competitive settings can create unfair advantages and can be self-defeating. Non-positional goods, on the contrary, are less context-dependent and are desirable for their own sake (Ranisch, 2019). Of course, some could reply that being very intelligent, for example, can be an advantage over less intelligent people. However, this does not preclude that being intelligent is intrinsically valuable because it allows us to develop different life plans without this necessarily being detrimental to others. Moreover, intelligence is an important cognitive component of the procedural dimension of autonomy, as we shall see below.

In summary, each GPM is a kind of Swiss Army knife — a multi-tool pocket-knife — that is useful in a wide variety of contexts. In most cases, GPM are multivalued traits that are desirable for their own sake because they help us pursue a vast range of life plans.

4.3 The capability approach

The capability approach is a normative framework about positive freedom and wellbeing that remarks the importance of what individuals are able to be and to do (Nussbaum, 2007; Sen, 2009). Although this theory has been largely unattended in the human enhancement debate, I have recently argued along with Pablo García-Barranquero and Francisco Lara that this framework can consider biomedical enhancements as a legitimate goal of medicine as long as they make people freer (Rueda et al., 2021). Here I argue that, if reprogenetic enhancement improves future children's capabilities, these individuals could be considered freer. Moreover, this is the case even if the enhanced capabilities are not necessarily GPM. I shall distinguish between *capabilities* and *functionings* to make my point clearer. Whereas functionings are the actual beings and doings, capabilities are the substantive opportunities to develop those beings and doings. This is easier to understand returning to the example of the introduction.

Thomas and Hannah have chosen genetic predispositions related to musical and athletic abilities. Their child would have the substantive opportunity (i.e., the capability) of doing sport or playing music (i.e., functioning) with greater talent because of her genetic endowment. This also means that she would have greater freedom to be a musician or athlete due to her genes. But if she did not want to play music or to be a musician, she would still have the opportunity to refrain from it because having enhanced traits does not necessarily oblige to undertake a certain type of functioning. On the contrary, without that enhanced genetic predisposition, she would be less capable or would require more assistance to develop significant musical or athletic abilities. That is to say, having enhanced capabilities on a different range of talents concede greater positive freedom than not being enhanced on those talents.

In addition, the capability approach stresses the importance of all types of conversion factors — the social, environmental, and biophysical aspects that influence the transformation of a good or resource into a functioning one (Robeyns, 2016). Several capabilities have a biological and genetic baseline (Papaioannou, 2013; Venkatapuram, 2013, p. 278). For instance, the substantive opportunity to become a musician not only depends on conversion factors such as family support (formal or informal), musical education, or access to instruments but also on abilities that are genetically influenced. Genetic enhancement could therefore empower those capabilities whose conversion factors are mediated by the genetic endowment of each person. The child of Thomas and Hannah would not be more determined due to having enhanced some genetic predispositions. But rather, if she had reason to value the life of an athlete or a musician, she would have more substantive opportunities to realize those beings and doing thanks to genetic enhancement.

Consequently, we can conclude from the capability approach that genetic enhancement is not inimical to the substantive freedom of the future child.

4.4 Procedural autonomy

Neither autonomy is a univocal concept, nor do philosophical approaches to autonomy stress the same facets of this term. In this last subsection, I will address whether genetic enhancement could enhance procedural aspects of autonomy. I shall clarify first the core foundations of procedural autonomy. Proceduralist accounts emphasize the processes of self-reflection and self-revision that are necessary to make personal choices. A prominent version of this account was defended initially by Harry G. Frankfurt (1971). According to him, an autonomous agent is not only the one who does what she wants but also the one who is free to want what she wants to want. Technically speaking, Frankfurt mainly used the term *freedom of the will* instead of *autonomy.* His proposal, moreover, was a hierarchical procedural account, that is, a view that gives more importance to second-order volitions and desires. First-order desires or motives are those “to do or not to do one thing or another” (Frankfurt, 1971, p. 7). Second-order desires or motives, by contrast, imply wanting to have (or not have) those desires or motives. On the main proceduralist views, the main characteristic of autonomy is the reflective self-evaluation over first-order desires (Frankfurt, 1971; Dworkin, 1988). In addition to understanding autonomy as a second-order (or higher-level) capability, procedural accounts commonly stress content-neutrality and the absence of comprehensive substantive values (Christman, 2005).

Understood in this way, autonomy refers to the process of making choices according to personal standards, reflected preferences, and long-term goals. Autonomy as a procedural capability highlights on the revisionist and critical processes for scrutinizing personal desires before translating them into action (Malmqvist, 2007, p. 408). The procedural account highlights the capabilities needed to pursue a particular lifestyle and to choose between a range of significant options in an informed and rational manner. In this sense, Matthew Clayton identifies a limit to reproductive autonomy: Parental genetic choice must not be deprived from the mental and physical capabilities needed to lead an autonomous life (Clayton, 2002, p. 200). But what is at stake here is the possibility of enhancing them, not just abstaining from diminishing or depriving them. In what follows, I shall point out two possibilities which I consider that could genetically enhance procedural autonomy: the former concerning cognitive enhancement, the latter concerning the genetic basis of addictive behaviour.

Firstly, *genetic cognitive enhancement* could be a possibility to improve procedural autonomy. Genetic cognitive enhancement refers to improving the likelihood of having a child with increased intelligence, particularly boosting cognitive performance in domains such as working memory, executive function, information processing speed, episodic memory, selective attention, and sustained attention (de Araujo, 2020, p. 3). Admittedly, intelligence is a trait that raises major scientific and social controversies, especially when it is measured only through IQ tests.[12] However, at the genomic level, there is increasing evidence that supports that intelligence is a complex trait with a considerable genetic basis. Today, intelligence is at the forefront of behavioural genetics research (Plomin and von Stumm, 2018). Although much about its genetic underpinnings is still unknown, intellectual abilities are influenced by more than 500 genes (Hill et al., 2019). Some particular genes correlate with greater or lesser intelligence. For instance, the DTNBP1 genotype is associated with general cognitive ability (Burdick et al., 2006); the KLOTHO gene is related to non-verbal reasoning ability (Deary et al., 2005); and the BDNF is associated with age-related cognitive change and decline in non-demented individuals (Harris et al., 2006). Taking into account the (partial) genetic contribution of intelligence, genetic interventions that enhance future children's cognitive abilities can make them more autonomous (Schaefer

12 See Anomaly (2020:3 et seq.) for the "politically motivated resistance" to research in intelligence.

et al., 2014). Enhancing attention and long-term memory can help to realize self-determined life plans; and improving information processing is valuable to deliberate about personal desires and to make informed decisions (Juth, 2011, pp. 36–37). Moreover, enhancing mental abilities related to executive functions could improve self-determination and the freedom of will (Heilinger and Crone, 2014, p. 15). Therefore, if genetic cognitive enhancement is possible in the future, it can lead to procedural autonomy enhancement.[13]

Secondly, Frankfurt's seminal article analysed the case of the "unwilling addict" (Frankfurt, 1971). An unwilling addict desires to take the drug and desires to refrain from taking it. From a procedural perspective, what is more important is the second-order desire. If her second-order desire is to refrain from taking the drug, this is what would constitute the genuine will of the unwilling addict. She would be really autonomous if she could carry out her rational and deliberate choice of abstaining from consuming the drug. I find this example particularly stimulating for the debate of reprogenetic enhancement. Addictive behaviours and substance abuse are genetically influenced to some extent. Notwithstanding the environmental, developmental, and socioeconomic factors that affect pathologic addiction, the *genetic basis of addictive disorders* is widely supported by evidence (Mitchell, 2011; Ducci and Goldman, 2012; Epps and Wright, 2012). If possible, genetic enhancement technologies should reduce the likelihood of developing addictive behaviours. Procedural autonomy leads us to value self-regulation abilities that are related to the psychological hallmarks of addiction, such as impulse control, delay discounting, or reward processing. A person who can control her own addictive tendencies is more autonomous than a person who is not able to do so. Although this is a possibility that has been largely underexplored in the human enhancement debate, I think that genetic technologies should thus target the predispositions to addictive behaviours to achieve more autonomous agents.

In a nutshell, reprogenetic technologies could in theory enhance procedural autonomy. Cognitive genetic enhancement and targeting the genetic basis of addictive behaviour could be two promising ways to achieve that goal.

5. Conclusion

I shall recapitulate the two most important claims that I have argued throughout this article. On the one hand, I have analysed four *procrustean parenting*-kind objections against genetic enhancement: the genetic tattoo, autonomy as self-

13 One issue that I cannot address here is the potential of procedural accounts regarding moral enhancement (see Schaefer & Savulescu, 2019). The possibilities of moral enhancement at the prenatal level could be endorsed by normative stances like the principle of *procreative altruism*, which values the selection of traits that contribute significantly to the wellbeing of others (Douglas & Devolder, 2013).

authorship, hyper-parenting, and parental expectations. I have argued that these objections are ill-founded. They are not persuasive enough to claim that reprogenetic enhancement will make future children less autonomous. On the other hand, I have addressed four frameworks — child's right to an open future, general purpose means, the capability approach, and procedural autonomy — which show that enhancing the autonomy of the descendants through reprogenetic technologies is a plausible and desirable option.

Finally, there are three limitations that I would like to outline: First, genetic enhancement can improve the capabilities related to autonomous agency. Future children may benefit from certain genetic choices made by their parents. Seen like this, parents' reproductive autonomy and the principle of the best interests of the child seem to be in tune. Still, in this article, I have not focused on a third main element necessary for ethical analysis: the societal consequences of genetic enhancement. On an intuitive level, I think that having more autonomous people benefits society. But the issue of societal consequences is much more complex than this. Genetic enhancement can also have negative externalities that must be addressed in detail (see Anomaly, 2020; Cavaliere, 2020). In the case of autonomy enhancement by reprogenetic technologies, we need an extensive future analysis regarding its societal consequences.

Second, fair access to reprogenetic enhancement technologies is a major ethical issue. Concerns regarding distributive justice are fundamental and can influence our judgements about genetic enhancement. Elsewhere I have defended that autonomy enhancement is a legitimate goal of medicine and that there are reasons to publicly subsidize medical interventions aiming to improve the capabilities needed to lead a more autonomous life (Rueda et al., 2021). That said, further investigation is needed regarding the ethical foundations of the public subsidizing reprogenetic technologies.

Last but not least, it remains an open question how genetic enhancement could be addressed from relational accounts to autonomy. The social preconditions of the autonomous agency are important in the discussion of genetic choices about future children's autonomy (Barclay, 2003). In this sense, the framework of relational autonomy is a promising avenue to overcome excessively narrow and individualistic approaches to autonomy. Similarly, autonomy enhancement should not be restricted to the individualistic myth of self-sufficiency that has mainly dominated in some transhumanist proposals (Liedo and Rueda, 2021).

Given these omissions, it is evident that this article's contribution is modest. I hope that these limitations may pave the way for further research and engage in future meaningful discussion in the fascinating genetic enhancement debate.

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