Mediation and the Morality of Sex Selection

Contributions of a Mediation Approach to the Assessment of Sex-Selection Technologies

Master Thesis

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Summary

This thesis handles the question whether mediation analysis can be a valuable addition to the contemporary ethical assessment of sex-selection technology. The origin of this question lies in two specific critiques on the current methods to assess new and emerging technologies. The first critique is that current technology assessments often overlook softer impacts of technology, such as impact on our existing values and practices. The second critique is that the current assessment methods often approach technology with an instrumental view, that results in solely an assessment of consequences of technological availability. Yet, from the postphenomenological viewpoint, technology is mediatory in the relationship between human beings and the world. It creates or contributes to certain perceptions and actions (due to its mediatory character) and as such actively influences the way we look at things and influences our decisions on 'what to do'. When this mediatory role of technology is considered, assessing new or emerging technologies may result in different moral questions that would have remained hidden in the classical approach of technology assessment.

To see whether mediation analysis indeed results in different moral questions, a concrete technology was taken for analysis and put to the test. Innovations in sex-selection technology that are currently in development potentially have a huge impact on procreation. As we will be able to choose the sex of our offspring in a safe and easy way, it is easily imaginable this has quite some influence on society. Earlier assessment of sex-selection technology led the Dutch government to ban all methods for sex selection for non-medical reasons in 1998. Back then, there were no methods for preconceptive sex selection available. As a result, it had to be performed at the embryonic stage, with the necessary discarding of multiple embryo's. This, together with other ethical issues, led to a ban on sex selection for non-medical reasons. However, new technologies for sex selection are being developed that can be used in the preconceptive stage It may be obvious that these methods cause less ethical issues as there are no multiple embryos needed to determine the sex.

Although the arguments that are used to assess sex selection certainly are relevant, they are based on a metaphysical perspective where autonomous human beings put a neutral technology to use. Yet, from Postphenomenology (and our own daily experiences), technology is not a neutral intermediate, but has an intentional character in mediating our access to the world. The question that follows is how sex-selection technologies exactly ‘mediate’ the way we look at procreation and our offspring, and the options and actions we are able to do regarding procreation and sex selection? To answer this question, first empirical information was gained from 'practical experts': people who currently are considering using sex selection, and discuss possible argumentations on internet forums. These public discussions were analyzed to identify moral issues or concerns regarding the (potential) availability of sex-selection technology, and to identify the way technology impacts our values and practices. It is concluded that the moral categories of these practical experts for a great deal overlap with the categories that follow from literature, yet the moral issues identified within each category may differ. It seems that in literature mostly negative arguments for the possibility for sex selection for non-medical reasons are posed, whereas in public discussions also positive arguments are being exchanged. Next, in public discussions there occasionally seems to be a more nuanced view on typical arguments presented in literature. On the other hand, sometimes the arguments in public discussion are quite emotional or based on presuppositions.

The empirical information was used to analyze how sex-selection technology mediates either certain perceptions or observations, or choices of action that are available with this technology. With the use of the postphenomenological dimensions (existential/hermeneutical), it was analyzed how sex-selection

technologies might amplify or diminish certain perceptions or invite or inhibit certain actions. This analysis resulted in a substantial amount of information on the possible mediations of sex-selection technology.

It is concluded that some of the identified mediations of sex-selection technology is not accounted for in the current assessment of sex selection. It seems that the critique on contemporary technology assessment in the case of sex-selection technologies are correct. As it turns out, in the assessment of sex selection the soft impacts are (at least partly) overlooked, and there is no analysis present regarding the mutual shaping of technology and society. Hence, current assessments do not account for possible changes in our moral framework regarding sex selection and use the present moral framework as a fixed set of values for the assessment of sex-selection technology. As a result, relevant moral issues do not come into view, with the risk of a too narrow assessment and lack of recognition and understanding of how sex-selection technology may have impact on society regarding specific values and behavior/actions of its citizens. Hence, it is concluded that a mediation analysis in a technology assessment can prove to be a valuable addition compared to other contemporary approaches.

Index

1 Introduction

1.1. Reproductive Technology and Sex Selection

Currently, reproductive technology is defined as the use of different technologies and treatments for (human) reproduction. It includes In Vitro Fertilization (IVF) and Intrauterine Insemination (IUI). In case of IVF, where the embryo(s) are created outside the body, it can be combined with Pre-implantation Genetic Diagnostics (PGD) to analyze the (in vitro) created embryos for certain characteristics or genetic defects. As such, PGD is often used for two indication groups: the first group are individuals with a high risk of having a child with a genetic disease. The other group consists of individuals treated with IVF with the goal of maximizing the chance of an ongoing pregnancy[1]. In that case, the embryos are screened for 'chromosome aneuploidies'[2]. If an embryo is free of defects it can be placed into the womb for further (normal) development, the other embryos (with and without defects) are discarded.

PGD can also be used to diagnose the presence of the X or Y chromosomes which determine the sex of the embryo[3]. To use PGD to identify the specific sex is mostly only allowed to prevent sex-linked disorders in children from passing from parents to child. The reason for this - besides the fact that the method is costly and demanding for the person(s) undergoing this procedure - is that there are ethical controversies regarding the embryos needed for a successful result. Only the embryo with the desired and best genetic characteristics is used, the others are being destroyed. This method and the destruction of embryo's is subject of ethical debate. There is broad consensus that PGD should only be used for medical reasons[4], and not for sex selection for social reasons (i.e. fulfilling the wish of parents to have a child of a specific sex).

1.1.1 Innovation in Technologies for Sex Selection

Although non-medical sex selection is momentarily only (limited) allowed in the US, in several countries experiments take place with sperm separation methods[5]. In the last few decades, new technologies are being developed that use a different method for sex selection.

A well-known method in breeding practices for mammals is flow cytometry, yet application for human beings is theoretically possible as well. With this technology, sperm-cells are separated in two groups carrying either X- or Y chromosomes. The differential DNA in the sperm cells are identified by using a fluorescent dye that binds to the DNA (the method is known as FISH - Fluorescence In Situ Hybridization). Using UV-light to recognize the different fluorescent DNA structures, sorting of the X- or Y chromatozome bearing spermatozoa is possible using droplet charging[6]. This method is not (yet) available for human spermatozoa, but Microsort (based in the US) has been given an exclusive permission to use the patented flow cytometric sperm separation technology for development and use for human reproduction[7]. They have successfully been able to achieve pregnancies after Intrauterine Insemination (IUI), In Vitro Fertilization (IVF) and Intracytoplasmic Sperm Injection (ICSI). The combination of identification and sorting technologies result in a ratio of X- to Y-bearing sperm of 88:12 for X-chromosome sorting, and 27:73 for Y-chromosome sorting. As a result, 92% of the babies born are female after X- sorting, and 82% of the babies born are male after Y-

[1] Serman et al. (2004)
[2] Mahowald (2000)
[3] Tizzard (2004)
[4] In the Netherlands, pre-implementation diagnostics for sex selection was prohibited in 1998, following the advice of the Dutch Health Council from 1996.
[5] Strange et al. (2010); De Geyter et al. (2013)
[6] Johnson (2008)
[7] Karabinus (2009)

sorting[8]. There is no evidence that malformation rates of babies conceived using Microsort is different to that of the general population.

Another less known method is 'Lab-on-a-chip Technology', and is currently developed at the University of Twente. A lab-on-a-chip is a micro-laboratory the size of a post stamp. These devices are equipped with very small channels, which can be used to for example separate tiny drops of fluids. With this capability, there are many different applications possible, one of them being sex selection. This is done by using a chip to separate sperm-cells based on the difference in characteristics between sperm-cells carrying X-chromosomes or sperm-cells carrying X-Y chromosomes. With this method however, in the process of separation currently the cells become heavily damaged. Hence the method is not yet successful in providing separated living cells to use for conception. It will probably be a matter of time before the method is optimized and will be successful.

Flow-cytometry and lab-on-a-chip are especially interesting, since the use of it poses none of the ethical challenges abortion or destruction of healthy embryos (as in PGD) have. Since application of both methods is in the pre-conceptual phase, there are no issues regarding multiple embryo's or the discarding of the ones that do not have the desired sex. It will also be obvious that - for those parents that have a wish for a specific sex - it will be a great relief if a method is found that is easy to use, not very costly and does not need multiple embryos. Also, it might relief some indication groups from the not very comfortable methods of for example PGD and IVF in case of medical sex selection.

In the light of technological developments, there is however growing ethical discussion regarding the non-medical use of sex-determining methods. Proponents of the use of these methods for sex selection see it (amongst others) as a method for family balancing or freedom of 'expression', whereas opponents argue we interfere with the natural course of things, play God, or find ourselves on a slippery slope heading for the disastrous 'designer baby'. It is understandable that discussions on these technologies take place, as it touches the boundaries of the human being, and how we understand ourselves. It is also easily imaginable that a safe and easy method to determine the sex of one's offspring will have an enormous impact on society. When there indeed will be a technology available that overcomes the ethical issues that are present with current methods, the question rises *how to assess this technology*?

1.2 Assessment of New and Emerging Technologies

A systematic methodology for technology assessment became formalized in the 1960s in the US when the 'Office for Technology Assessment' was installed. This office had the responsibility to research short- and long-term consequences of the application of technology[9]. Europe followed the American example by the establishment of several technology assessment institutions in several European countries.

These assessments are often commissioned by policymakers and used to decide whether the technology is to be permitted, how it should be regulated, et cetera. Often, as the technological developments are new, these assessments are also anticipatory to some extent. As a result, the anticipated impacts are also highly speculative. To help them turn into manageable risks, they are often specified according to dimensions of quantifiability, clear and non-controversial values (such as 'health' or 'safety) and direct causal relations (to make sure the impact results only from the technology in question)[10].

[8] Karabinus (2009)
[9] Banta (2009); Tran et al. (2008)
[10] Swierstra (2015)

1.2.1 Current Technology Assessment: Possible Limitations

With the use of the contemporary assessment methods, the desirability of technologies is regularly decided on the possible social, economic and environmental impacts of new technologies. According to Philosopher of Technology Peter-Paul Verbeek, this consequentialist approach ignores the fact that subject, technology and society are intrically related, and cannot be isolated from eachother[11]. New technologies result in new practices, new experiences and new ways of living. Many moral dilemmas for example are the result of the availability of specific technologies. Hence, Verbeek proposes 'Postphenomenology' to better understand the relationship between technology and the human being. In this approach, technology is being understood as 'a mediator' of human experience. According to Verbeek, this accounts for the mutual shaping of technology and society, and morality, and is very well suited to be used for the assessment of technologies.

Another line of critique is coming from Philosopher Tsjalling Swierstra. According to Swierstra, next to the typical 'hard' and quantifiable impacts' that are analysed in a technology assessment, technology often has an impact on 'softer' issues as well, for example on our values, relations, routines and our explanation of what is meaningful. Swierstra is of the opinion we cannot ignore these soft impacts in technology assessment, especially as they are becoming increasingly prominent in our society. They also come with some normative challenges however, including the mutual shaping of technology and morality, and the anticipation of the soft impacts, which require a qualitative approach rather than a quantitative approach such as with the anticipation of hard impacts[12]. Despite these difficulties, we must take up with these challenges, and find methods to anticipate these soft impacts. According to Swierstra also, mediation analysis can be a helpful tool to anticipate soft impacts of technology by identifying changes in our practices and values.

1.3 Subject of Research

Following the idea of Postphenomenology, the question is whether the contemporary way of assessing new or emerging technologies gives a complete account of what is at stake. Although many different methods for technology assessment have been introduced the last decades, from the postphenomenological perspective their conception of the relation between technology and society is not fully accurate. To not account for the mutuality between technology and society (and ethics) could result in a too narrow approach in the technology assessment. After all, if the implicit values underlying the assessment of the technology in question are taken as fixed, they will remain hidden in the assessment procedure. Accounting for the reciprocity between technology and society means analyzing how current values are technologically mediated, and how new technology might change these values due to its mediation.

The question following from these statements is whether Postphenomenology with its practical mediation analysis can add to contemporary ethical assessments of technology. By analyzing technologies for sex selection aas a concrete technology that is in its design phase, this thesis tries to understand possible limitations of the current ethical assessment, and discover how a different perspective of the role of technology can potentially add to the analysis.

As was written in the first paragraph, developments in sex-selection technologies like flow-cytometry and lab-on-a-chip will have a profound impact on the (clinical) practice. In case of lab-on-a-chip, this technology can possibly even be used in a home-setting. The fact that it is not very costly and rather simple means that it has the potential to be available at a large scale. It is imaginable that a safe and easy method to determine the sex of one's offspring will have an enormous impact on society. When there indeed will be a technology

[11] Verbeek (2011)
[12] Swierstra (2015)

available that overcomes the ethical issues that are present with current methods, the question rises how to assess this technology? The traditional approach would mean to ask the question whether we should allow this technology to be introduced, and if so, on what grounds? Yet, Postphenomenology starts with the idea that the technology mediates our relationship with the world, and specifically our ideas, values and practices surrounding reproduction and offspring. Instead of answering the question whether we should allow for this technology to be introduced, we could study the specific mediations that come about using this technology, and use these insights to come to a responsible application of the technology.

1.3.1 Research Questions

Based upon the theory and case presented above, the main research question of this thesis is:

Can mediation analysis be a valuable addition to the contemporary ethical assessment of sex-selection technology?

To answer this question, the following sub questions are formulated:

- How is sex selection currently assessed? What is at stake according to the existing analysis?
- What is the impact of Postphenomenology on current assessments methods? How does a different perspective on the role of technology influence the ethical assessment of a new technology such as sex selection?
- How can we anticipate for the (soft) impacts of technology, and specifically for sex-selection technologies?
- How does sex-selection technology mediate our perception of the situation and our actions in this situation?
- What moral questions result from a mediation analysis of sex-selection technology?
- Is mediation analysis a valuable contribution to the contemporary ethical assessment methods?

1.4 Thesis Outline

To answer the main question and subquestions, this thesis starts with an overview of the current ethical assessment of sex-selection technology in the Netherlands. It is concluded that based on specific moral arguments that overlap with arguments from academic literature sex selection is forbidden. In Chapter 3, a short theoretical analysis on Postphenomenology and mediation is presented to understand the concept of mediation, how it sees the relation between technology and morality and how it differs from the contemporary view. Next, in Chapter 4, ethical technology assessment is discussed, including its potential shortcomings. Based on literature, a broadened framework for assessing new and emerging technologies is presented. This framework is based on empirical information, which is given and analyzed in Chapter 5, specifically for sex-selection technologies. It is concluded that people in their everyday morality partly see different moral issues and have different moral concerns than identified in the current assessment. In Chapter 6, mediation analysis is further used to explore how sex-selection technologies can mediate our perception and actions of relevant issues in the case of sex selection. Finally, in Chapter 7, it is concluded that mediation analysis results in some additional and relevant material for technology assessment. In Chapter 8, conclusions are drawn regarding the main question, and the validity of the results are discussed. Also, some comments and suggestions are given for further research, and for possible expansion of technology assessments with the inclusion of mediation analysis in the assessment procedure.

2 Current Ethical Assessment of Sex Selection

Sex selection, or more specifically the activity of determining (influencing) the sex of the newborn child to be male or female, is not new for our time nor for our culture. However, a lacking in understanding of genetics and the workings of our reproductive system has placed historical attempts under the header of folk tales and nostrums[13]. This however changed with modern medicine, and more specifically the developments in reproductive medicine and medical genetics over the last few decades. As a result, sex selection became available to the public in the late 1980's, when preimplantation genetic diagnosis (PGD) combined with in vitro fertilization (IVF) became a possible method for couples to determine the sex of their offspring. This method however has some ethical difficulties, especially considering the necessary discarding of embryos in the process. As a result, this treatment is strictly regulated to make sure the necessity of the selected sex is motivated only by medical reasons[14].

However, as was written in the introduction, advancements are being made in alternative methods for sex selection that do not have the ethical difficulties surrounding PGD. Methods like flow cytometry and lab-on-a-chip technology could possibly make sex selection easily accessible for the wide public. This has consequences for the ethical debate as well, considering that these technologies are often suggested for the possibility of sex selection for non-medical reasons.

A clear overview of ethical arguments exchanged in the debate around sex selection for medical- reasons as well as non-medical reasons is lacking however. Hence, the objective of this Chapter is to give an overview of the current ethical assessment used for policy regarding sex selection in general, and specifically for the Netherlands.

2.1 Biomedical Ethics

Although medical ethics is as old as medicine itself, its fundament and relation with medical practice is continuously changing. Scientific- and technological development, societal changes and reflection on ethics itself have changed medical ethics to the point where it is today[15]. The field has expanded as well: it no longer covers only the relationship between patient and doctor, but also health in societal context, healthcare, health policy, health innovations, et cetera. To account for this change in the theoretical field of medical ethics, in the US the term 'bioethics' has come to be used. It now covers a wide theoretical field, including not only ethics of healthcare of - healthcare delivery, but also moral reflection on all sorts of scientific- and technological developments[16]. In short: the object in (moral) question is no longer the individual, but covers the whole of society including all sorts of societal change (in the biomedical context). Yet, definitions remain somewhat blurred, as both (and other) terms are occasionally and interchangeably used in different contexts. In this thesis (and in much of the relevant literature) the term 'biomedical ethics' is used to indicate that the range of both 'domains' is relevant.

Especially in the US (and to lesser extend in Europe), the work of Beauchamp and Childress has had great influence on the development of biomedical ethics[17]. Drawing on the deontology and utilitarianism, the two ethicists have distilled four principles that overlap or hold the middle ground between the theories with respect to moral problem solving[18]: respect for autonomy, beneficence, non-maleficence and justice. It is often referred to as 'the Four Principles Approach' or simply 'Principlism'. The principles are prima facie

[13] For an overview of sex selection in different times and cultures, see Sills et al. (1998)
[14] Strange et al. (2010)
[15] See also ten Have et al. (1998)
[16] Ten Have et al. (1998)
[17] Hølm (1995)
[18] For a detailed explanation of the four principles, see Beauchamp & Childress (2009)

binding, they initially do not hold a hierarchical position over each other (but in a specific situation they can be overruled by each other).

In ethical literature on sex selection, there is regularly reference to these four principles, yet can also come from deontological or utilitarian standpoints directly. Hence, it is useful to give a very short overview of the two dominant ethical theories, as their fundamental approach to morality is relevant for the remainder of this thesis as well.

In short, deontology is mainly based on the idea that actions are intrinsically morally right or wrong[19]. Its principles have been formulated by Immanuel Kant in the late 18th century[20]. Kant argues that the human being not only is the cradle of all knowledge[21], he is also the sole author of all moral actions since morality is seated in a priori reason[22] [23]. As a result, the principle of morality is a standard of rationality that he coined the "Categorical Imperative". There are two formulations of the categorical imperative, the one being the principle of universalizability and the other being the principle of humanity [24]. The principle of universalizability comes forth from the fact that Kant grounds moral law in practical reason. Kant's first formulation of the Categorical Imperative runs: Act only according to that maxim by which you can at the same time will that it should become a universal law. The principle of humanity on the other hand states that one should always treat humanity as an end, and never as a mere means. To treat someone as an end means treating someone with respect, on the basis of the person's rationality and autonomy. Also, autonomy is typically related to moral agents, and (especially for Kant) an important precondition for the possibility of morality[25]. In (bio)medical ethics, this is mostly translated in principles of autonomy (e.g. in choices, rights, informed consent and medical confidentiality) and justice (e.g. fair distribution of scarce resources (distributive justice), respect for people's rights, and respect for (morally acceptable) laws).

Utilitarianism as an ethical theory is not at all concerned with the moral deliberations of the subject. It is actually a family of theories that have one central principle: that the moral assessment of actions is generally a matter of how much 'good' these actions result in, or how much 'bad' they avoid[26]. There are two main viewpoints of theory, being act and rule utilitarianism. The first is focused on actions producing maximization of happiness or minimization of unhappiness, forbidding all other actions. Rule utilitarianism on the other hand is based on the idea that morally right actions are based on optimal social rules, i.e. rules that generate optimal results when they are widely endorsed[27]. For act utilitarianists there are no absolute moral rules, there is only the one moral problem in front that requires incidental assessment. This is different for rule utilitarianists, morally right actions refer to rules that are worth preserving because they generally produce good. This holds even if the specific case might end up in a 'suboptimal' result. In general, for a utilitarian approach to biomedical issues, knowledge and transparency is needed regarding risks and probability of innovations or treatment in assessing harm and benefit[28]. Also important to recognize is that benefit for the one is not necessarily benefit for the other, or the benefit for one person is not necessarily beneficial for society.

[19] Shafer-Landau (2013)
[20] Groundwork of the Metaphysics of Morals, Kant (1785)
[21] See Critique of Pure Reason, Kant (1781)
[22] See also Guyer (1998, 2004)
[23] For Kant (and deontology in general), autonomy is an important precondition for the possibility of morality.
[24] Shafer-Landau (2013)
[25] Schneewindt (1998)
[26] Shafer-Landau (2013)
[27] Shafer-Landau (2013)
[28] Gillon (1994)

These theories (nor the principles discussed above) should not be taken on their own as an isolated standpoint, but as an approach to a moral problem that is always related to other principles. In practice, one never adopts only a deontological or utilitarian approach to an ethical problem, but uses these viewpoints as an instrument to identify, analyze and balance as much aspects of the ethical problem as possible. The same holds for the four principles, they should not be taken on their own as isolated principles, but as an approach to a moral problem that is always related to other principles as well. As a result, arguments can also be combinations of viewpoints which are hard to ascribe to one specific theory or principle. This also holds for the ethical discussion on sex selection that will be discussed in the next paragraphs.

2.2 Ethics of Sex Selection for Medical Reasons

Regarding the ethics of sex selection for medical reasons there is a considerable amount of literature present that mostly take PGD as their point of departure. What is debated in these articles is whether the medical reasons for sex selection are 'good enough'[29][30]. To evaluate this, often the utilitarian approach is taken[31], and more specifically the principles of beneficence and non-maleficence. A sex specific disease may lead to suffering, if for example the child indeed is carrying the specific chromosomes related to its sex. To be sure, this suffering only happens when the disease indeed realizes itself, and hence the chance of this to happen is part of the debate of 'a good enough reason'.

There are several counterarguments against sex selection for medical reasons, and they generally fall into one of three rubrics[32]: 1) arguments that reject an 'instrumentalist view' of human life, 2) arguments that reject interference with the natural generative process, and 3) arguments that center in the ethics of discrimination.

With regard to an instrumentalist view of human life, there are people who are opposed for to the destruction of embryos for any reason, medical reasons included. According to them, an embryo is a person and hence a right-holder[33] (with autonomy, a right for aid, freedom, etc.). As a result, they see PGD as infanticide regarding the embryos that are discarded[34]. This could be seen as a deadlock position, as the opponents see the right to life as the result of interpreting human fetuses or embryo's as in fact persons. Proponents however base their arguments on the status of the embryo's as well, which they see as lacking the essential marks of personhood[35]. Here we end up in the debate of the moral status of an embryo, one that continues to be extensively discussed in all kinds of literature and in society.

Next, there is a group that is against interference with the 'natural reproductive system'. These arguments lay largely in the domain of risk when we allow artificial interventions in human reproduction. The fear is that since we do not fully understand our reproductive system in detail, we might lose control of the system altogether[36]. As a result, our choices might produce inferior genetic quality resulting in all kinds of undesirable traits and genetic defects. This may be damaging to the process of natural selection and hindering human evolution.

[29] See also Macklin (2010)
[30] Interestingly, what is not discussed in ethical literature on the subject is the fact that pre-conceptive technologies (like flow cytometry and lab-on-a-chip) are an ideal solution to overcome some of the ethical problems of PGD. After all, these technologies have the ability to eliminate the moral issues related to the discarding of embryo's.
[31] Akchurin (2008)
[32] Kluge (2007)
[33] Liao (2005)
[34] An intermediary position is possible as well, as most people take a developmental view about the moral status of the fetus, and yet the rights of the embryo are stronger the closer it gets being born. See also Macklin (2010).
[35] Mahowald (2000)
[36] Liao (2005); Akchurin (2008)

Finally, there are arguments that center in the ethics of discrimination. One of the arguments has to do with societal perception of a 'normal' condition of human life once we allow for selecting against certain disabilities. PGD is performed for the sake of the child, who will be spared a 'worthless' life. Yet, this will be highly demoralizing to born disabled people[37]. It may also create societal pressure on couples to decide to make use of PGD to limit the chances of children with disabilities. Finally, another argument comes from the notion of good parenthood. Some people claim that by using PGD to prevent children with diseases means treating a child as mere means to an end. Instead, good parents show unconditional acceptance, regardless of any of the characteristics of the child including medical ones. Some articles oppose to sex selection for medical reasons with arguments that center in the ethics of sex discrimination. However, since PGD is disease based, one might argue that this basis is unsound. It does however have a relevant connection with the ethics of sex selection for non-medical reasons, it hence these arguments will be discussed in the next paragraph.

2.3 Ethics of Sex Selection for non-medical Reasons

Regarding non-medical reasons for sex selection, two main ethical justifications for sex selection can be identified that partly can overlap: 1) reproductive liberty; and 2) the (morally neutral) desire of parents for a specific sex in the context of family balancing.

Reproductive liberty (also phrased as 'procreative autonomy') is basically framed as the liberty to have or not have children, but can also include the freedom for specific characteristics of the children to form the family the prospective parents desire[38]. This justification however must satisfy the condition that no harm is done to the child or anyone else. There is however no evidence that sex selection causes significant harm to the children born[39]. As a result, in a democratic society that values liberties such as reproductive choice, it is argued that the decision for using technologies for sex selection should rest with the couple concerned.

A typical personal reason is when parents have a strong preference for a specific sex as the result of having one or more children of the other sex. In literature, this is often called the 'family balancing' argument. As the wish for family balancing may be coming forth from personal preferences only, it is not necessarily based on any sort of discrimination. If the wish for a specific sex however is based on a different valuing of either of the two sexes, it is mostly considered discriminatory and ethically wrong.

Against the reasons for people to choose the sex of their child, in public and professional discussion over the past few years, also several arguments against sex selection have been put forward. These arguments can be divided into three main groups: arguments based on discrimination, arguments based on the slippery slope principle ('what will be next?') and arguments based on 'consumerism'.

One of the arguments is that many of the traits we understand to be typical for males or females are socially and culturally, but not genetically determined. As a result, we are selecting children with particular traits, and hence discriminate against the other sex (with the other, 'undesired' traits). It is argued that non-medical sex selection is therefore directly equal to sexism: before parents can possibly know anything about their child, they place central value on the child's sex[40]. Related to this is the concern of the limitation of each sex to a narrow set of culturally dictated roles. It might restrict children to certain expression, and put pressure on them to behave according to typical sex stereotypes[41]. It is also argued that fulfilling parent's wishes for

[37] Mahowald (2000)
[38] Hens (2013)
[39] Tizzard (2004)
[40] Strange et al. (2010)
[41] Strange et al. (2010)

family balancing results in an 'artificial' kind of family. As family balancing aims towards a sex balanced family, it promotes a restrictive conception of family as well. Whereas nowadays the (liberal) conception of family becomes more wide and inclusive, family balancing reinforces the view that there is a single or ideal family unit and hence is regarded socially outdated and ethically inappropriate[42].

Sex selection is sometimes referred to as the first step to a 'designer baby'. It is argued that now we choose the sex of the child, but in a few years we can select eye color, length, etc. According to some, this is dehumanizing to the child and compromises their dignity[43]. It is also argued that this continuously further replacing the natural with the artificial is equal to 'playing God' or interfering with nature's course of things[44].

Finally, many opponents of sex selection for non-medical reason argue that choosing the sex of one's child is just one other form of consumerism. This perspective on children as consumer products and their traits as commodities is regarded morally wrong, and contrary to the perspective 'good' parents have on their children. An important parental virtue that is mentioned in that regard is 'acceptance' of the child, regardless of his or her specific characteristics. The argument is that sex selection is incompatible with parental virtues and duties, such as unconditional love and acceptance[45]. If these virtues are not present, the 'flourishing' of the child might be in jeopardy ultimately damaging the child. Another argument in this line is the argument that parents do not fulfill their duty to create an open future for their child[46], but even make him or her subject to a 'technological destiny'[47].

2.4 Assessment of Sex Selection in the Netherlands

In 1995, the Dutch Health Council[48] (Gezondheidsraad) in the Netherlands published a report on sex-selection. The Council was of the opinion that sex-selection is not inherently discriminatory neither necessarily instrumental in character, although motives of parents might indeed be based on this. Also, the Council was of the opinion that sex-selection is not inherently damaging to the emotional development of children, and in general that the situation of slippery slope need not be the case. Yet, although the arguments presented against sex selection are not necessarily the case, the Council did warn for the risks of the possibility that sex selection might happen for the wrong reasons, or that it might result in undesirable consequences (such as a damaging situation for the child or the loss of moral boundaries in case other characteristics can be manipulated in the future).

Coincidentally, the advice suddenly got public attention when in the same year a clinic for sex-selection announced to start practice in the Netherlands[49]. The clinic used a preconceptive method for sex selection ('Ericsson method') claiming to be able to increase chances of a specific sex to 80%. Public debate started as newspapers paid attention to the clinic and the arguments surrounding sex selection for non-medical reasons[50]. Also, the Rathenau Institute[51] organized a public questionnaire, where the dominant opinion of the public was that sex selection for non-medical reasons should be forbidden. The debate partly took place

[42] Strange et al. (2010)
[43] Macklin (2010)
[44] Macklin (2010)
[45] Strange et al. (2010)
[46] Feeney (2011)
[47] Akchurin (2008)
[48] The Health Council is a governmental institution in the Netherlands which advises the Ministry of Health on scientific knowledge and developments with regard to public health and health(care) research.
[49] The foundation 'Gender Preselection' started its practices in Utrecht, 1995.
[50] de Volkskrant (1996): 'Meerderheid bevolking wil verbod geslachtskeuze baby in kliniek'
[51] Organization for Technology Assessment, founded by the Ministry of OCW and part of the KNAW.

in Parliament, where several questions were asked to the Minister of Health, mostly on whether we should allow these practices to happen.

Based on the mentioned arguments and risks in the advice of the Dutch Health Council, combined with the results of the public deliberation, the Minister of Health commissioned a ban on preconceptive sex selection in 1998 for reasons other than medical[52]. The justification for this ban follow the ethical discussion above: the rights of the child as a stakeholder, the argument of a slippery slope, reproductive freedom and the instrumental view on human life.

Later, in 2002, the ban was further grounded by law with the establishment of the 'Embryowet', stating that it is forbidden to perform embryo selection with the aim to decide the sex of the embryo that is placed back into the womb, except for medical reasons. The elaboration on this law declares (amongst others) that children may not be reduced to an object of wishes and belongings of their parents[53]. A year later, the moral status of the embryo together with the slippery slope argument were the main reasons for the Dutch Health Council (Gezondheidsraad) to advise the Government (again) to only allow PGD for specific reasons. Yet, they also argue for a societal deliberation on cases that could possibly be allowed, to see what other reasons than medical should maybe be a reason for postconceptional research/selection in the future.

Due to technological developments, the Health Council advised in 2013 to reevaluate the ban on sex selection, as developments (sperm separation methods) made preconceptive sex selection possible which make the screening (and selection) in the embryonic stage completely unnecessary. Despite this advice, the Minister reasoned that the arguments from 1995 (partly) still were present and relevant: even though PGD as a method was surpassed, the risk of an instrumental view on human life and children was not. In 2016, this is still the present situation.

[52] Staatsblad van het Koninkrijk der Nederlanden, Jaargang 1998 (336). Besluit van 26 mei 1998, houdende een verbod op geslachtskeuze om niet-medische redenen (Besluit verbod geslachtskeuze om niet-medische redenen)
[53] Memorie van Toelichting Embryowet (2002)

3 The Role of Technology in our Lives

In our current time, the presence of technologies in our lives seem to increase on almost a daily basis. And not only is this process continuously speeding up, the technologies seem to become increasingly pervasive. Sex-selection technology is a good example for that matter, as it touches upon our understanding of what it is to be human. As a result, many ethical arguments (mostly the conservative ones) find their origin in the idea that the human being is 'at stake'.

As was mentioned in the Introduction, the desirability of new technologies is often decided on based on the possible social, economic and environmental impacts of the specific technology in question. Yet, according to Philosopher of Technology Peter-Paul Verbeek, this approach for assessing technology ignores the fact that subject, society and technology are bound together. New technologies result in new experiences and new ways of living, and many moral dilemmas are the result of the availability of specific technologies[54]. It would therefore be wrong to separate and isolate the technological domain and the social domain if we want to understand and assess new and emerging technologies. Postphenomenology is presented by Verbeek as a way understand the relationship between technology and the human being. This chapter explains Postphenomenology as part of the Philosophy of Technology, as it is the theoretical foundation of mediation analysis.

3.1 Popular Conceptions of the Role of Technology

The growing importance of technology gives rise to new (moral) questions, and asks for a better understanding of the relationship between human beings and technology as such. In many contemporary assessments, a reflection on the role of technology is missing in the analysis. The reason for this is that the relationship between technology and the human being mostly is conceived with two traditional approaches[55]. On the one hand, there is the instrumentalist view that considers technology as a mere means, or instrument for the human being to achieve specific goals. Technology is represented as 'neutral', it has no effect on the subject or goal except for its instrumentality.

The other, the substantive view, is opposed to this and considers technology as having a deterministic influence on the human being and society. Technology is regarded as an autonomous force, that might be incontrollable for the human being. To be effective in their analysis, both the instrumentalist view and the substantive view suppose a strict separation between human beings and objects. If not, to be sure, a technology cannot be neutral nor act as an autonomous force. The conception of the human being, its subjectivity and autonomy is just as well the result of this a specific metaphysical framework. Either we are autonomous beings that simply put the neutral technology to use, or we are the victim of an oppressing technological force that has spun out of control.

From a closer analysis, we might consider this strange as technology changes the way how we live, experience and act in the world. According to Verbeek (amongst others), empirical research shows that technology acts not at all according to these traditional representations[56]. Hence, Postphenomenology regards both traditions as not being viable any longer, as they do not do justice to the complicated relationship between human beings and technology. In contrast, it regards technology as mediatory, influencing the way we experience and act in the world. And, as a result, it also understands both subject and object as constitutive for each other, meaning we cannot meaningfully understand the one without the other.

[54] Verbeek (2011)
[55] Verbeek (2005)
[56] Verbeek (2005)

3.2 Postphenomenology: Analysis of Experience

The term 'Postphenomenology' was coined by American philosopher of Technology Don Ihde in the late '70s, in his books Experimental Phenomenology (1977) and Technics and Praxis (1979). Although Ihde was the first to come up with the term, many philosophers after him have shared their own definition of Postphenomenology. According to Ihde, Phenomenology in Europe, and Pragmatism in the United States can be seen as the theoretical branches from which Postphenomenology is an offshoot[57]. Both movements view (albeit differently) human experience as one of the key concerns of philosophical inquiry).

Selecting the viable and useful theoretical parts, Don Ihde uses both Phenomenology and Pragmatism to come to his relational philosophy, giving experience a central role for analysis. Ihde wants to overcome the problems of idealism in the phenomenological tradition, and focus on the experimental. Hence it can be characterized as a *non-foundational* and *non-transcendental* philosophy.

3.2.1 Viable Elements from Phenomenology

From both Pragmatism and Phenomenology, Ihde adopts their interrelational ontology. By this Ihde means that human experience ontologically is related to an environment or a world. The central idea of intentionality in Phenomenology is taken over and adapted by Ihde, and brought in the realm of his philosophy of technology. For according to Ihde, our intentionality towards objects or the world is changed when we make use of technology. Technology is able to 'modify' our perception and experience of the world in many ways. Yet, the relation is such that both are transformed in this relationality (hence the inter-, in interrelational). This way, Postphenomenology overcomes the subjectivation of Phenomenology, moving beyond the subject-object thinking of the traditional Cartesian approaches[58].

Beside intentionality, Ihde draws three main elements from Phenomenology for his analysis of experience[59]. First there is variational theory, which is the central method of experiential analysis. In Phenomenology, variations are used to determine essential structures or essences by determining what is variant and invariant. Following the pragmatist ideas on truth and knowledge, in Postphenomenology the idea of essentialism is not viable. However, variational analysis can alternatively be used to determine something what Ihde calls 'multistability'. Instead of finding absolute knowledge, or 'essences', Ihde shows how interpretation can be different depending on the context.

Second, there is embodiment. According to Ihde, embodiment plays an important but implicit role in the experiential analysis. The perceptual engagement needed to find the different variations described above shows the 'situated and perspectival nature' of bodily perception. The materiality of technology, the bodily techniques of use, and the cultural context are all important factors in the variations of meaning of artifacts. Yet, bodies are not transcendental according to Ihde, but 'cultured' and sometimes even 'gendered'. Material cultures (artifacts and technologies) are taken in human experience through human-technology relations[60]. "Intentionality, now not 'consciousness per se' but embodied, includes material technologies in various

[57] Ihde (2009)

[58] While Phenomenology may be of great value for Postphenomenology, Ihde argues that some concepts of Phenomenology must be rejected as well. One thing to let go is the notion of the transcendental subject or ego. This notion was based on the idea that epistemology is always representational, i.e. that the external reality is not directly experienced by the subject. This way, there arises the problem of correspondence between internal- and external reality. For how can we be sure that the world we perceive is exactly the world as it is? This gives rise to the concept of transcendentalism, that there is a world 'out there' which we do not perceive. This typical modern problem Ihde refers to as an epistemology engine: it immediately gives rise to a whole set of epistemological questions. With his empirical approach, Ihde steps away from this classical and dystopian generalization of technology. Technologies should not be looked at from a transcendental perspective, but should be seen as 'material cultures within a lifeworld' (Ihde, 2009).

[59] Ihde (2009)

[60] Ihde (2003)

positions as I relate to a or any 'world'. This way, subjectivity is substituted for embodiment in Postphenomenology[61].

Third and final, there is the notion of lifeworld. Ihde describes this notion as part of the empirical turn in philosophy. According to Ihde, there is one more step needed to come to a contemporary philosophy of technology. A pragmatic Phenomenology is also empirical by definition. What is to be added is an empirical focus in the analysis of technology and human-world relations. Instead of all kinds of generalizations about technology, Ihde wants to examine technology 'in their particularities'. It is a step away from the transcendental perspective on technology that was dominant in a great part of the 20th century, and a step towards the understanding of the 'multidimensionality' of technology'[62].

3.2.2 Structure of Human-Technology Relations

Although Ihde wants to step away from generalizations of technology, there are some characteristics that specific technologies have in common. These characteristics are important for the kind of relationship we have with a specific technology and the world. Ihde distinguishes between three kind of relations of how human beings can relate to a specific technology: a relation of mediation, an alterity relation and a background relation. For this thesis, only the relation of mediation is relevant, as one of the goals of this thesis is to analyze how sex selection technologies mediates our perception and actions about procreation and our offspring[63].

In the relation of mediation, our perception is mediated by a technology or technological artifact. We do not have direct access to (a part of) the world, or a direct body-sensory experience, but only through the technology in question. Ihde distinguishes between two types of a relation of mediation: embodiment relations and hermeneutic relations. In an embodiment relation, the technology in question withdraws from our experience and becomes transparent. They do not call attention to themselves, but to (aspects of) the world given through them. For example, when hammering a nail in the wall, your attention is on the nail and the hammer withdraws from your experience. The moment you hit your thumb though, you are suddenly painfully aware again of the hammer. With hermeneutic relations, we are connected through the technology with the world as well, but this time the technology does not withdraw itself. Rather, it gives a representation of the world that needs to be interpreted (which is why Ihde calls is a hermeneutic relation). Of course, since the representation is mediatory, the way the technology represents the world transforms our experience of it. A good example is a thermometer or a decibel-meter. It is a device that measures a certain aspect of the world (i.e. temperature or sound), and represents this in a value (or maybe even a symbol or a picture).

In these relations, technology mediates our perception in a specific way. According to Ihde, this transformation of perception has the structure of ***amplification*** and ***reduction***. With this Ihde means that by using a technology that mediates our perception, certain aspects of reality become enlarged by the technology, whereas other aspects are diminished. It is important to realize though that Ihde does not mean that our perception of reality becomes reduced or that our correspondence with it becomes deformed. Unmediated perception is impossible, what reality 'is', is predetermined in the human-technology relationship. As such, it can even be possible that technology opens new aspects of reality that were impossible before.

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[61] Ihde (2003)

[62] Ihde (2009)

[63] In the alterity relation we are not connected to the world mediated by an artifact, but to an artifact itself. We are solely focused on the artifact which role can be characterized as 'quasi-other'. With regard to background relations, the artifacts in question do not take a central role in our experience, but hide in the background as it were. The technology shapes the context of our experience which we do not experience consciously (See also Verbeek, 2005). Both of these relations however are not mediatory, and hence are not relevant for the remainder of this thesis.

3.3 Broadening Postphenomenology: Analysis of Action

Verbeek, as one of the main contributors of the field of Postphenomenology, follows Ihde's hermeneutical framework of human-technology relations, but points out there is an existential dimension as well. Although Ihde's framework is perfectly able to answer the question of the role that technologies (or technological artifacts) play in how we interpret reality, it does not give an answer to the question of the role of technology in shaping our actions and existence[64]. In other words, with Ihde's framework we are able to identify and describe the way how technology mediates our perception, but not our actions.

Verbeek finds this existential dimension earlier being developed by French philosopher Bruno Latour. Latour shares the modernist critique of Ihde, in that it makes little sense to distinguish human beings and society as separate entities[65] . The only thing we can find is that in reality all is mixed up in a 'Gordian Knot'. Latour's hypothesis is that the confusion has risen by mixing two specific practices that had to remain distinct to be effective for the stability of the modernist paradigm. These practices are 'purification' (strict separation) of nonhuman nature and human culture, and translation which "creates mixtures between entirely new types of beings, hybrids of nature and culture". Modernism, says Latour, only works if these processes are kept strictly separate. Although moderns have been using both dimensions, they have never acknowledged the relationships between these dimensions. In society and nature, we do not find 'pure' subjects and objects at all, we can only find complex mixes, or 'hybrids' as Latour calls them. As long as we consider humanism as a contrast with all the objects, neither human nor nonhuman can be properly understood according to Latour.

The fact that Latour just rejects a fundamental separation between subject and object not only has important implications for the role of technology, but also our conception of subjectivity. If we cannot discriminate a purified subject against a background of objects, how could we ever speak of an autonomous subject? What holds for the subject must also hold for his intentions, his freedom and his autonomy: they are just as well the result of things (subjects and objects) outside the subject in question. Latour's philosophy hence is much about human beings not being autonomous actors, but who's actions are co-shaped by the technologies they use. Not only are actions decided on by human intentions, but also by their material environment. They do so by the use of 'scripts'[66]. These scripts function as a guideline or prescription of how the artifact should be used. For example: the heavy label on the key of your room in your hotel says: "when you leave, give me to the bloke at the reception" (classic example of Latour), or the script of the paper box our BigMac comes in is: 'throw me away after you've finished your (not-so splendid) burger'. Just as is the case with mediation of perception, with mediation of action transformation occurs when technology is used. In the case of actions, these transformations are *translations* of 'programmes of action'. A program of action can be appointed to human beings as well as material things. When a human being makes use of a specific technology, the program of action of the technology **invites** or **inhibits** (or discourages) certain behavior. As such, his program of action becomes 'mixed' with the program of action of the technology in question. The result is a specific composition of humans and non-humans that together have formed a hybrid with a specific program of action.

It is important to realize that this structure of invitation and inhibition is context-dependent as well (as with transformation of perception). As such, Ihde's concept of multistability can be applied for the dimension of praxis also. After all, a hybrid is always a composition between a human being and an artifact. The mediating role of technology hence is the result of this composition, and not a property of the specific technology. As such, the mediating role of the technology differs with respect to the use-context.

[64] Verbeek (2005)
[65] Latour (1993)
[66] Latour (1992); Verbeek (2005)

3.4 How Technology is Intertwined with Morality

As technology is able to change our interpretation and judgment of reality, and is able to change our plans of action, this has consequences for morality as well. If we approach the human being as part of a relationship, ethics does no longer solely belong to the realm of the human being. Intentionality and freedom of the subject can no longer be regarded as the prerequisite for making moral decisions or performing moral actions. According to Verbeek, when we understand ourselves as subjects as opposed to a world of objects, we detach ourselves, and do not see the network of relations we are in[67]. When we are cycling towards our work, or preparing a dinner at home, we find ourselves in a web of relations in which we are intertwined with other humans and things. On our bike for example, we are in a close relationship with our bicycle, but also to the street, traffic lights and not to forget other road users. If we detach ourselves from the world by seeing ourselves as subjects opposed to it, we do not see the interrelationship of people and things. We do not see how they are related to each other, form each other and give meaning to each other. Moral action therefore is an affair that takes place in close cooperation between humans and non-humans.

In 'Where are the missing masses: a sociology of a few mundane artifacts', Latour describes the way in which we form alliances with technology, particularly for morality. In this work, Latour points sociologist complaining on the loss of morality to look at other places for morality as well. We should not only focus on the human being for moral behavior, nonhumans should be considered as capable of moral actions as well. Many moral decisions, we delegate agency to all kinds of objects: speed bumps to slow us down, springs on our doors to close them, shopping trolleys with a coin slot so we return them, et cetera). All these objects contain certain 'scripts' and stimulate or demand certain behavior. The way nonhumans impose behavior back to humans is what Latour calls 'prescription'. As such, they fulfill an important role in the moral behavior. They open and close possible actions, and with that the result of the moral action itself.

Latour's philosophy describes on a meta-physical level how the relationship between human beings, technology and the world is mis-taken in a modern view. We should look at human beings and technology as hybrids which together perceive or take action in this world. It is the construction of 'we' as hybrids that determines the outcome of moral action.

According to Verbeek then, we should look at technological artifacts as being 'morally charged': they mediate our moral decisions, shape us as moral subjects and play a role in moral agency[68]. Technology can for example change social values and practices. The relationship between technology and society is not on-directional, both domains constitute the other in what you could say is a symbiotic relationship. Summarizing, as ethics is about the question 'what to do', or 'how to act', we must conclude from Postphenomenology that this answer is partly formulated by technology as well.

3.5 What is Left of the Moral Subject?

Until recently, the Postphenomenological framework has very much focused on (the mediation of) specific technologies. Yet, technology represents only one side of the actors in the human-technology relationship. For human beings, the question is how technologies become part of their lives and how they adapt to new technologies to form new ´human-technology relations´. In other words, how human beings appropriate new technologies, and how they are constituted in their subjectivity themselves[69]. But also, how moral values, considerations and decisions take shape when technological mediation and human appropriation are combined?

[67] It is also important to mention that Verbeek is not of the opinion that the modernist metaphysics of subjects versus objects has no legitimacy at all. It is for example the basis of modern science and has made possible a vast field of scientific research. However, what Verbeek does say is that the modern approach to human beings and the world should not be seen as the only one with validity.
[68] Verbeek (2008)
[69] Verbeek (2011)

Verbeek uses an original reading of French philosopher Michel Foucault to demonstrate how human subjectivity takes shape. In his earlier work, Foucault analyzed society in terms of power structures and power relations. Subjectivity in this sense should be taken literally for Foucault: it is about subjecting oneself to all sorts of power. In his later work, Foucault focuses on how human beings need to find a relationship with these power structures, since they are shaping their lives. Yet, these powers should not be seen as forces that limit the subject externally[70]. We are confronted with these powers every moment of our lives, and hence they are very important in the constitution of our subjectivity. However, it is certainly not the case that Foucault defines a deterministic view of these power structures in forming the subject in its being. Rather, to constitute our subjectivity, we engage with these powers in our lives, and find a free relation to it. Contrary to Kant, who saw freedom of thought as a necessary precondition for morality, Foucault reinterprets the idea of freedom to account for the intricate relationship human beings have with all kinds of power structures in their environment. In Foucault's analysis, freedom is no longer a state the subject finds himself in as one where all external powers are absent that are of influence. Rather it is defined by the way we *take up* with these powers[71]. Foucault's moral subject hence is the result of the freedom and engagement with all sorts of power relations in its environment. Foucault refers to this as 'care of the self'. By knowing yourself in different situations, by practicing and by styling your behavior, you can shape yourself as a moral subject, resulting in a sort of 'aesthetic of existence'[72]. It is important to realize that these practices and moral behavior can only happen in freedom, says Foucault. For without this freedom, power relations and subjective constitution would inherently be impossible. Hence says Foucault, freedom is the ontological condition for ethics[73].

This is very valuable for understanding the role of the subject in an ethics of technology. It is not very fruitful to perceive the moral subject as an autonomous, isolated being that is opposed to technology or the world. Especially with the current pace of innovation and the penetration of technologies in our daily lives, it is impossible to ignore or 'keep out' technological developments. When technologies are interpreted as specific power structures, then the question is how we can shape our subjectivity in our intertwinement with technology? The fact that we are fundamentally technologically mediated beings certainly does not mean the end of ethics. Rather, as Foucault teaches us, it is the starting point of shaping yourself as a moral subject in relation to technology.

3.6 Ethics of the Good Life

For Foucault then, ethics is not to follow moral laws or codes, but 'styling' or giving shape to one's existence. The self is not given according to Foucault, we must constitute it ourselves using self-practices which help to shape ourselves as moral beings. Foucault's ideas of moral subjectivity are derived from the classical interpretation of ethics in Greek philosophy known as Virtue ethics or Good Life ethics. Aristotle argued that 'eudaimonia' is the greatest good achievable. It is the highest cultivation of personal character, and with that it constitutes the good life[74]. This highest human good is always choice worthy, not as means but as an end. Moreover, it is also always complete in that it is self-sufficient, it could not be made better by the addition of any other sort of good. Eudaimonia refers to living a certain kind of life, a life in which one is 'living well' and 'doing well', and which can be translated in contemporary culture as human 'flourishing'[75]. Virtues and

[70] Verbeek (2006)
[71] Verbeek (2011)
[72] Foucault (1997)
[73] Foucault (1997)
[74] Bauer et al. (2008)
[75] Denis et al. (2011)

virtuous actions are inextricably linked to eudaimonia, as they are not just mere means to human flourishing, but largely constitutive to it. It is the enduring and controlling element of flourishing[76].

According to Verbeek, the ethics of the good life can offer an interesting alternative to modernist ethical frameworks. The modernist question is 'how I should behave' (as a moral subject), whereas from the perspective of the good life the question is 'how to live'[77]. This way, ethics is not reserved for the question of how much we should allow technology into the 'realm of the human being', but can also be pointed at what would be a good way of living with technology. Following Foucault, Verbeek sees this approach as a practice of shaping ones technologically mediated existence, rather than a framework to decide the moral acceptability of technology. As such, good life ethics can play in innovative role in the assessment of technology. Instead of protecting humanity against technology (as is often the contemporary approach), Verbeek argues for experimentation with technological mediations in that people can shape their lives in responsible ways in close connection with technology[78].

Yet, if we do not explicitly choose whether we find a technology morally acceptable, are there no reasons at all to 'prevent' us from technologies doing harm? The answer according to Verbeek is no: as Foucault indicates, freedom (in the specific interpretation of Foucault) is the necessary condition for self-constitution. When it is not possible to develop a free relation to a specific technology in question, it dismisses the possibility to shape our existence in relation to it. When the outcome of technological mediation is technological domination, a crucial condition for being human is lost.

What technology assessment will look like considering the specific role of technology and its mediations will be subject of the next chapter.

[76] Denis et al. (2011)
[77] Verbeek (2012)
[78] Verbeek (2012)

4 Technology Assessment: A Different Approach?

In the introduction of this thesis a short introduction was given on Technology Assessment. Some critique on the current methods was given as well from the point of view of Philosophy of Technology. This chapter tries to shed some further light on the contemporary technology assessment methods, followed by suggestions from some authors of how an assessment method could account for both the soft impacts of technology as well as the mutual relation between technology and society.

4.1 Technology Assessment

Technology assessment as the activity to reflect on the possibilities and possible consequences of new or emerging technologies is something that probably is as old as humanity. Yet, a systematic methodology became formalized in the 1960s in the USA when the 'Office for technology assessment' came into use. Set up by the U.S. Congress, this office had the responsibility to research short- and long-term consequences of the application of technology, such as societal-, economic-, ethical- and legal consequences[79]. The goal of this analysis is to come to an earlier awareness and understanding of what might be the social, economic, political, ethical and other consequences of the introduction of a new technology into society. The installation of the American Office of Technology Assessment (OTA) was followed in Europe by the establishment of TA institutions in several European countries that drew on the American model of assessment. The most successful variants were the Environmental Impact Analysis (EIA) and Risk Analysis (RA). Also, European TA institutions designed assessment procedures on their own, like participatory TA (pTA) and Constructive TA (CTA). Most of these methods however include only a limited part for ethics in the assessment procedure. This minor role for ethics has been taken up by some authors who argue that exactly early involvement of ethics can be valuable for the technology design process[80].

4.1.1 Ethical Technology Assessment

Although anticipation of consequences and weighing possible risks and benefits seems exactly like an ethical activity to do, Palm and Hansson argue for an ethical supplement to technology assessment. They introduce Ethical Technology Assessment (eTA) as a supplement to anticipate on negative ethical impacts at an early stage of technological development. Because moral problems may arise at every phase in the technology development, sufficient attention for ethics should be continuously present in the process. It is the task of ethics to reflect and support the moral development during the technology design process. According to the authors, the relationship between technology and society should be taken as an interplay between technological potential and social values. This means that societal values are brought in during the development of technology, and that the technology can be ‘shaped’ with these values in mind. Palm and Hansson hence see ethics as a critical companion in the R&D process, continuously reflecting on- and assessing the result of the interaction between technological possibilities and social values. To support this, they present an ‘ethical checklist’ that can be used in during the developmental phase, and inform the assessment on most common problems. The checklist contains critical issues that seem to be relevant for most common problem areas, and hence can serve as an early warning system.

Although the words ‘interplay’ and ‘ethics as a companion’ might sound like the interdependency between technology and society that is unaccounted for in the traditional approaches, this unfortunately is not the case. The checklist seems to prescribe the values that are relevant in the assessment procedure. This way, the interplay between technology and society is understood as an interplay between 'variable' technological

[79] Banta (2009); Tran et al. (2008)
[80] See Palm & Hansson (2006);

potential and 'fixed' societal values.

Hence, although their method clearly shows a decisive and iterative role for ethics in the designing- and assessment procedure, the understanding of the authors of the relationship between technology and society limits their analysis. Although the outcome of the assessment certainly can be useful to shape the technology in an ethically desirable way, it does not consider how technology might actually change societal values, and how our perception might be changed regarding what relevant values are. What remains hidden in ethical technology assessment (and other contemporary approaches) is the fact that technology influences the ethical criteria to be assessed. We could say that these methods are all victim of what is labelled 'moral presentism'[81]. As a result, the focus of these approaches is on the consequences of technology introduction and use, and the role of ethics will not go beyond assessing consequences based on existing norms and values. To be fair however, in the end of their article Palm and Hansson do mention that technology may affect moral values and principles, yet this is only after they have presented their approach, and hence this insight seems not to be part of their methodology[82].

4.2 Technomoral Change

In the previous chapter, it was explained how from the postphenomenological perspective technology is intertwined with morality. Technology can fulfill an important role in morality, by closing or opening possible actions. Specific technologies can also for example be morally charged, by designing explicit scripts for use. The mutual shaping of technology and morality is sometimes referred to as technomoral change. In the Introduction of this thesis, it was already claimed that current assessments of new and emerging technologies often focus on quantifiable hazards or risks and changes of occurring. Also, as others have argued, ethical assessments of new and emerging technologies often judge future technologies with today's moral norms and values, showing 'moral presentism'. The current morality is taken as fixed, and serves as the starting point for the anticipation and assessment[83]. Morality in this respect is defined as the implicit set of values and norms that a specific community considers important. What is forgotten in contemporary assessments is that new technologies might result in moral change, for example because its use results in some principles being interpreted differently over time. Some values can change: for example, become more important, understood differently or simply be replaced and disappear[84].

What is often overlooked according to some authors are the soft impacts of technology. New technologies not only come with risks for health and safety, they may also impact social practices and routines, and the morals underlying these practices. These soft impacts however are a lot harder to deal with, as they are mostly qualitative, unclear or contested and co-produced by the user rather than only being the consequence of the technology[85]. As a result, they are often (sometimes for conventional reasons) overlooked. Although these 'soft' influences of technology on society is quite different in character from the quantifiable hard impacts, according to Swierstra it results in a same kind of normative question. Knowing that technology and society influence each other also means we have the moral task to shape it according to what we (as society) think is best. By introducing new ways of acting in this world, technology pushes the boundaries between fate and will[86]. Technology makes things possible that were considered 'fate' before. And as it increases our choices, it increases the domain of morality as well. A new situation of choice often leads to new obligations and rights, and consequently a deliberation (hopefully) which choice to make. This also means that our

[81] Boenink et al. (2010)
[82] This conclusion is also drawn by Boenink et al. (2010)
[83] Boenink et al. (2010)
[84] Boenink (2010)
[85] Swierstra (2013)
[86] Swierstra (2013)

accountability increases as well: we have become responsible for our choice, simply by the fact that the technology is 'there', or present. Technology increases the domain of morality by expanding our choices.

With regard to technology assessment, the mutual relationship of technology and morality has consequences for the way we look at new technologies. After all, if technology influences morality, it influences the values as well we use to assess the very technology in question. In other words, our normative standards to assess technology are affected by the technologies they intend to evaluate[87].

There is a problem however in anticipating how exactly technology might influence morality. Efforts to do so can easily be set aside as speculation or 'moral futurism'. In reality, we do not know whether our morality indeed will change in this direction as it is dependent on many other forces. In other words: we are torn between moral presentism and moral futurism. As a way out, to increase the probability of technological anticipations, Boenink et al. (2010) present a framework for building scenario's that enhances the techno-moral imagination by anticipating how technology, morality and their interaction might evolve[88]. To prevent 'free-floating' speculation, they call for an historically informed anticipation that uses tropes and patterns from previous ethical debates[89]. Their idea is that when we compare the moral present with plausible moral futures, it is possible to sensibly enrich our moral judgments on emerging technologies.

Although with their approach they may indeed add to the reliability of their speculations on technomoral change, it does not analyze how exactly the 'moral variability' comes about. Although they try to anchor their framework in historical analysis, one might question the reliability of the scenario's. In how much does history repeat itself, and is their approach in the end not another example of speculative ethics? Here, a mediation approach may be a very valuable addition. With mediation analysis, it is possible to analyze moral change while occurring. Instead of speculating on technomoral change, it is possible to explore the realization of it by looking at the way technology mediates morality. As such, the analysis should not focus on the outcome of technomoral change, but on the dynamics of the relationship itself. A preliminary attempt is made in the next paragraph.

4.3 A Mediation Approach in Ethical Technology Assessment

If we want to come to desirable technologies, we should assess technologies on their soft impacts for sure. But not only this, we should also account for the dynamic relationship between our moral framework and the technology that is being assessed. How can this understanding be translated into a framework of assessing and shaping of technology? It is useful here to differentiate between anticipation of mediations on the one hand, and assessing them on the other.

4.3.1 Anticipation of Mediations

As mentioned before, morality changes continually, with technology being one of the thriving forces. When new possibilities arise through technology, existing practices and their underlying morality can suddenly become destabilized. In that situation, the current morality becomes topic of discussion and may lead to possible modification. Before any assessment of mediations can happen though, it is still necessary to estimate or anticipate how the technology impacts the users and society. Anticipation is however a hard

[87] See also Swierstra (2013)

[88] The first step in this scenario-building framework is to analyze the present moral landscape. The second step is the introduction of a technological development and the (possible) impact on / interaction with the current moral landscape (this is imaginative). In the third step, preliminary closure of these controversies is constructed (based on historical and sociological analysis).

[89] See Swierstra & Rip (2007): Nano-ethics and Nest-ethics: Patterns of moral argumentation about new and emerging science and technology.

thing to do, as technologies do not always mediate in the way they were designed to do so. Due to its multistability for example, people find different ways or uses for a specific technology, which makes the meaning of the technology also dependent on the use context. This complicates the analysis since probably not all the different use contexts of a technology can be anticipated for, nor the way people give meaning to the technology.

Of course, this is exactly the reason according to Swierstra why current assessment methods leave these impacts out of the analysis. The question remains though how we can find as much soft impacts as possible. The answer for Swierstra is to localize them in our every-day morality:

"To a large extent our normative and moral know-how exists in the form of embodied knowledge, of tacit understanding, tightly linked to our emotions (e.g. compassion, gratitude, shame, guilt, pride, hate, disgust, resentment, embarrassment, indignation, humility). This know-how takes form in particular attachments, commitments, and character dispositions that make us value some things and detest other things." (Swierstra, 2015).

Here, morality is defined as a set of values and norms that a specific community considers very important [90]. According to Swierstra, this morality exists largely in the form of implicit beliefs, routines and practices. Soft impacts then can be localized in all sorts of 'practices' or 'routines' and the values underlying these practices. As soft impacts have an ambiguous character, they are not easily made visible. To identify the soft impacts says Swierstra, we need to articulate precisely the normative stakes inherent in our current practices, and how might they be changed by the technology in question. Knowledge of existing practices should empirically be gained from 'practical experts', i.e. people who now these practices inside out. Exploring their opinions on the specific new technology will (partly) show which values, ethical dilemmas, implicit assumptions etc. will be challenged by the technology in question[91].

The next step is to analyze how the technology in question mediates these values, dilemma's, etc. The philosophy of mediation provides a heuristic to explore those changes. In terms of the postphenomenological vocabulary, technology amplifies or reduces certain aspects of reality for the stakeholder. This is relevant since the actions of the stakeholders are based upon their perception of the situation. As a starting point for exploring the technological mediations, Swierstra and Waelbers suggest to focus on our reasons or motives for actions. As such, they distinguish three types of reasons on which people base their practical judgments: What ''is'' the situation? What ''can'' one do? And what ''ought'' one to do, given this situation and these possibilities? By mediating what we believe to be the case, what we believe to be possible and what we believe to be desirable, technology mediates the actions based upon these believes[92].

4.3.2 Assessment of Mediations

After anticipating as much of the mediations as possible, we need to assess the mediations found. Contemporary methods for ethical assessment of technology often make use of a set of ethical criteria (or 'checklists') that could be used to identify the soft impacts on society[93]. What is not accounted for in these methods is that new technologies might actually result in moral change, for example because its use results in some principles being interpreted differently over time. Some values can become more important (for example privacy), nuanced, or replaced by other values.

[90] Boenink et al. (2010)
[91] Swierstra (2015)
[92] Swierstra & Waelbers (2012)
[93] Boenink et al. (2010)

With mediation analysis however, we understand how this 'moral variability' comes about, and maybe even vary the design of the technology to change its mediating capacities. According to Verbeek, assessment of mediations can be done by focusing on four points of application[94]: intended mediations (by the designer), implicit mediations (evoked by the design), forms of mediations used and the outcome of technical mediations. All of these mediations should be assessed, though it can never be guaranteed that all possible mediations are accounted for. Unexpected use, due to new interpretations and appropriations will occur, that might result in the need to adjust the original design. Moralizing technology says Verbeek, is a "modest and tentative activity, not a high-handed enterprise for steering human behavior".

4.3.3 Combining Empirical Data and Philosophical Theories

The three questions from Swierstra and Waelbers serve as a good point of departure for exploring different kinds of technological mediations. The real challenge is answering them, as this is not an easy thing to do. Swierstra as well as Verbeek share the opinion that this kind of anticipatory exploration research needs philosophical structure (philosophy of mediation), but also empirical knowledge. We need as much insight as possible in our practices, current values, et cetera., and how might they be changed by the technology in question. At the same time, we need to be aware that our description will always be limited as it is impossible to make all practices and values explicit.

According to Swierstra, this knowledge of existing practices should empirically be gained from 'practical experts', people who now these practices inside out. Exploring their opinions on the specific new technology will (partly) show which values, ethical dilemmas, implicit assumptions etc. will be challenged by the technology in question. After this, the next step is to analyze how the technology in question mediates this. How do people take up with specific technological mediations? How do they position themselves when relating to the technology? How do they adapt their practices when they use the technology in question?

According to Verbeek, a mediation analysis means that Postphenomenology has to be taken one step further[95]. For Ihde, to understand the role of technology, we have to examine technologies 'in their particularities'. Verbeek agrees this is the starting point for philosophical analysis, but after the materialities of technology we should move our perspective towards the mediated human being. That is, we should not only study the technologies, but also human beings and the way they give meaning to the technology and its mediations. Rather than starting from a pre-given normative framework, we should start with identifying and analyzing the normative issues that come forward from people's everyday lives. As such, we should study how human beings give meaning to technologies and make them morally relevant in their conversations.

In the next chapter, the normative issues that arise according to the 'practical experts' are identified and be examined regarding sex-selection technologies.

[94] Verbeek (2011)
[95] Verbeek (2016)

5 Exploring Practices and Values regarding Sex Selection

The previous chapter described how norms and values in society are not explicitly present, but are hidden in our 'social practices'. This means that the soft impacts of preconceptive technologies on society are located there as well, and specifically in the changes that occur in these practices. The objective of this chapter is to explore which norms and values surrounding sex selection are discussed in society. Which norms and values become destabilized by the introduction of sex-selection technologies? What are the opinions or claims on the availability of sex selection? How do people think about its use? By analyzing public conversations, this chapter gives some insights of the impacts of sex-selection technologies on society. Although the results are purely explorative in nature, it may lead to a better understanding of how sex-selection technology affects relevant values regarding procreation and offspring.

5.1 Method of Analysis

Before going in-depth on the topic of sex selection, it is necessary to first design the method for the analysis or exploration of technological mediations. Exploring the opinions of practical experts will give insight in which values, ethical dilemmas, implicit assumptions et cetera will be challenged by the introduction of sex-selection technology. As these insights are qualitative in character, it logically follows that the exploration of these insights follow a qualitative method of analysis.

5.1.1 Qualitative Research Approach

There are many definitions of qualitative research available, but there is consensus that it is a naturalistic, interpretative approach concerned with understanding the meanings which people attach to phenomena (actions, decisions, beliefs, values, etc.) within their social worlds[96]. Qualitative methods can be used to obtain detailed knowledge about phenomena such as feelings, thought processes, and emotions that are difficult to gain with more conventional research methods[97].

As Ritchie et al. indicate, the choice of a method is very much dependent of the aims of the research and the specific research questions that need to be answered[98]. In this case, the aim is to explore what values become subject of discussion in public conversations on sex selection. The research questions to be answered can be formulated as following:

- Which values, ethical issues, practices etc. are topic of discussion in conversations on sex selection?
- How do these values and practices become challenged by technology?

Although the general aim of the analysis is exploration, it is also of interest not only *which* values and practices become destabilized, but also *how*. As was explained in chapter 4, to explore the technological mediations, Swierstra and Waelbers have suggested three types of reasons on which people base their practical judgments: what ''is'' the situation, what ''can'' one do and what ''ought'' one to do, given this situation and these possibilities.

Besides describing the values, ethical dilemmas, practices, et cetera in the conversations, for answering the research questions the research is also necessarily interpretative as well as explanatory. It is interpretative in that elements of the conversations are interpreted in terms of reasons and beliefs on which people base

[96] Ritchie et al. (2003)
[97] Strauss et al. (1998)
[98] Ritchie et al. (2003)

their practical judgments ('is', 'can' and 'ought'), and explanatory as mediation is used to explain changes in these reasons and beliefs by the availability of sex-selection technologies.

5.1.2 Data Collection

Within qualitative research, there is a choice between the use of naturally occurring data and generated data[99]. In the first situation, existing documentation is used for analysis, whereas in the second situation there is interaction between the researcher and the participants (for example with an in-depth interview). Obviously, this choice is also dependent on the data that is available already. Amongst the many things that the internet has brought us, one of them are digital forums on which people share their personal information. Often, these forums are organized or focused on a specific topic for discussion. This also holds for sex selection, several internet forums can be found on which people talk on the practice of sex selection, the methods available and especially on their moral concerns. Since this research is exploratory in character (and hence can never be exhaustive), and since data is already available in terms of conversations on internet-forums, the data that is already available will be used for analysis. Besides this reason of availability, there are practical reasons as well regarding the maximum size of the research project and the limited time available.

As there are currently (or have been) preconceptive methods and technologies available in the U.S. And Belgium to increase the chances for a specific sex of the child, there is a substantial amount of discussion and deliberations available on the internet from parents who are contemplating the use of such a technology. The empirical information for analysis is gained by examining and analysing public discussions on sex selection. Several internet forums and comments on YouTube videos have been consulted to collect a sufficient body of information for further analysis. Data was collected unobtrusively, there was no communication with participants whatsoever (non-reactive data collection).

Forums were found by entering keywords in the Google search engine. The keywords used were the following: "Microsort", "Gender Selection", "Family Balancing", "Sex Selection". Most often, these words led to websites containing information on fertility(treatments), assisted reproduction (IVF, ICSI, etc.) or specifically sex selection. Some of these websites accommodate a forum as well, where people can discuss several topics on different threads. Typically, people 'meet' on these forums to inform themselves on possible treatments and the experiences of others who have already started therapy. Also, on these forums discussions take place regarding ethical issues considering the different therapeutical options, but also the specific goals of parents for therapy (e.g. Sex selection).

To search within the forums, the same key words were used as the ones used to find relevant websites. When one of the reactions in a thread on a forum contained one of the keywords, the full discussion was analyzed for useful content. The following forums and key words are used as identify and collect data:

[99] Ritchie et al. (2003)

Forum	Type of Website / Forum and Language	Location on the web	Keywords or Forum Topic/Section
DC Urban Mom	Parental forum with wide range of parental topics / English (USA)	http://www.dcurbanmom.com	*Key words:* • "Microsort", • "Gender Selection" • "Family Balancing" • "Sex Selection"
Fertile Thoughts	Website and forum on Infertility, Trying to Conceive, Adoption, IVF, Surrogacy, Pregnancy, etc. / English (USA)	http://www.fertilethoughts.com	*Forum Section:* • "Family Balancing (Gender Selection)"
IVF-infertility	Website and forum that provides couples experiencing infertility with information about the causes and treatment of infertility including IVF / English (USA)	http://www.IVF-infertility.com	*Forum Topic:* • "In Vitro Fertilization (IVF)"
Zappy Baby	Blog, Forum and News on becoming pregnant, being pregnant and parenting / Dutch (Flemish)	http://forum.zappybaby.be	*Forum Section:* • "Preconceptie" *Key words:* • "Microsort" • "Geslachtsselectie" • "Family balancing"
Ingender	Forum and articles on sex selection methods / English (USA)	http://ingender.com	*Key words:* • Ethics • Ethical (as the whole forum is on sex selection, previous mentioned keywords are unnecessary to identify relevant conversations

Table 1a: Location and identification of data in forums surrounding the topic of sex selection

For the YouTube-videos no keywords were used, the whole discussion was analyzed for useful content.

Website	Name of the video	Location	Keywords
YouTube	Gender Selection - 60 Minutes with Dr Daniel Potter	https://www.youtube.com/watch?v=zNoM--mBbC0	None, whole thread
Youtube	How To Have A Girl - Gender Selection In America	https://www.youtube.com/ watch?v=KdULpD8u93g	None, whole thread

Table 1b: Location and identification of data in video channels (YouTube) surrounding the topic of sex selection

5.1.3 Analysis of the Data

As Pope et al. indicate, in qualitative research the analysis of data often begins already during data collection[100]. It may be clear that for answering the research questions, not all the conversations contain relevant information. Quotes were selected by examining the conversations on the mentioning of specific values (regarding reproduction, offspring, sex selection), discussions on the ethics of sex selection and discussions on the motives for sex selection. Categories were identified as they emerged from the selected parts of the conversations. Data were read and reread to identify and index categories and place them within these categories[101].

To interpret and analyze the data, the principles of conversation analysis (CA) was used. This type of analysis can offer insights in how (social) order is gained, sustained or becomes overruled[102]. It can be concerned with both the structural and sequential organization of conversation, as well as its substantive content[103]. Hence, especially with the latter concern, CA can give insights in the dynamics of the value system in conversations on sex selection. Yet, as conversation analysis often involves an active role of the researcher (for example by collecting data from semi-structured interviews), the method of analysis used for this analysis is a more limited interpretation of CA. Also, as conversation analysis is a very rigorous, labor-intensive and time consuming method, it is unnecessary to follow its requirements to the full extend for the exploratory purposes of this research.

As conversation analysis is interpretative by nature, a few remarks are relevant as contextual information before interpreting elements of the conversations on the matter presented later in this chapter:

- In discussions, sometimes the words 'gender' and 'sex' are used intermittently (or confused), where gender is sometimes used to refer to the sex of the child, or to refer to the (socially constructed) characteristics of being male or female.
- In discussions on reproduction, fertility and children, people sometimes tend to get high in their emotions and hence their language may become offensive. As a result, moderators delete contributions that are taken as rude or offensive (observed by an empty contribution with a mark that it is deleted by the moderator). Yet, for this research, these contributions may have been important as valuable information. To be sure, these collisions might identify the impact of technology on existing values and the destabilization of these values.
- On several forums discussions are mixed: when fertility issues are discussed, or technologies to overcome these issues, people tend to easily get irritated/offended when someone brings sex selection as a subject to the fore. Yet, as there are very few forums that specifically discuss sex selection, people hardly have another place to discuss this matter.
- The ethical part of the discussion (or whether it is 'right' or 'wrong' to have a wish for a specific sex of the child) is frustrated due to the previous remark as well. People tend to become very conservative towards sex selection if they experience fertility problems themselves.
- One specific site (Ingender) and a large forum that is used in this analysis is fully dedicated to sex selection. As a result, discussions are a lot more deliberative, sensitive and moderate. Yet, the majority

[100] Pope et al. (2000)
[101] This inductive process is known as 'grounded theory': all data are identified and examind using a process of constant comparison, in which each item is checked and compared with the rest of the data to establish analytical catergories (see also Pope et al. (2000).
[102] Ritchie et al. (2003)
[103] Ritchie et al. (2003)

of posters has an American nationality, and hence bias may exist in terms of values or subjects for deliberation, as well as the outcome.

5.1.4 Ethical Considerations

Any research study raises ethical issues (although different in magnitude) regarding the interest of people involved and the usability of data for the research in question. For this specific research, the 'Ethics Guidelines for Internet-mediated Research'[104] was consulted to identify ethical issues in the method that need to be assessed and could possibly lead to a change in the method for reasons at stake. All information used in this analysis was public without previous registration. For participants however, some of the forums require subscription to be able to post reactions. This subscription could add to the idea of participants that their communication took place in a private domain. Although many subscribers use 'alter ego's' or only first names (with some creative additions), for confidentiality reasons their reactions are anonymized in this analysis. As a result, traceability is more difficult protecting the participants, but consequentially also the trail for possible scientific repeatability is reduced. As the aim of the analysis is to explore how sex-selection technology affects relevant values and practices regarding procreation and offspring however, the method used maximizes benefits while minimizing potential harm.

5.2 Results of Conversation Analysis

After analysis of the several selected discussions on the internet forums and YouTube videos, it was obvious to divide the reactions into 4 categories of values:

1. Reproductive liberty;
2. Family structure;
3. Technological replacement (of natural processes);
4. Good parenthood.

Within these categories, multiple values can exist. Often, they are also mixed in the different conversations analyzed. In the sections below, the values that are at stake for each category are presented and discussed.

5.2.1 Reproductive Liberty

An important part of the public discussion is (implicitly) based on ideas of reproductive liberty. Below, some different conceptions of reproductive liberty in case of sex selection are presented and further analyzed with the use of mediation analysis. Note that in the following statements, the 'is', 'can' and 'ought' are mostly intertwined:

[104] British Psychological Society (2013)

[Person A]: *"You need to come to a decision based on the thoughts, feelings and decisions of you and your partner ONLY. You can't let the opinions of others affect your decision."*

[Person B]: *"Why deny this woman her choice of happiness? do their wishes impact your life? does it matter if there is a gender disparity? aren't you just worried because it goes against what you know? Liberty is the pursuit of personal happiness without depraving another of their liberty. u c?"*

[Person C]: *"Personally, I had no issues choosing to pursue sex selection (other than cost! lol). I believe we only live once, and it was up to me to try to make my life as happy/fulfilled as possible."*

[Person D]: *"I just want to experience parenting both genders."*

First, for these three respondents the understanding of reproductive liberty is based on the idea that whatever is available as technology, the choice to use it is up to the parents in question.

Considering person A, this person seems to understand reproductive liberty as the liberty to autonomously decide if and how one will have offspring (the statement is a response to a question from another person whether she should use Microsoft considering the negative attitude of others). As the availability of the technology will increase the number of options, it increases reproductive liberty. Also, person A seems to have an instrumental definition of technology in mind, as we should autonomously decide whether to use sex-selection technology.

Person B understands reproductive liberty more as a derivative of self-determination. He/she responds clearly to an earlier (negative) response on sex selection ("Why deny this woman her choice of happiness?"). Furthermore, just like person A, person B seems to have the conception that deciding for sex selection is a private issue, yet adds to this the criterion that it should not deprave others of their liberty. Also, he/she gives an interpretation/explanation for people being negative towards sex selection, being 'it is something that goes against what we know'. According to person B, this leads people to judge negatively on this sort of change or innovation. Next to this, person B has a goal-oriented interpretation of liberty in that he/she sees it as the basis to get to personal happiness. Just like person A, as the technology increases the available options, so are the chances of self-determination on this matter. The technology hence seems to mediate the consequences in that the 'right' sex of the child is seen as adding more to the personal happiness and the result of a personal decision. Although the specific sex of the child for some people might have been a part of 'the good life' before the technology was able to mediate, it now has become a personal decision of 'taking life in one's own hands'.

Person C seems to speak from personal experience. Just like person B, person C seems to have the interpretation that being able to choose the specific sex of the child results in a happier and more fulfilled life. Sex-selection technology is able to do so, and hence it is up to the couple/parents to decide whether to use it or not.

Person D posts a quite simple but strong message: isn't it interesting to parent both genders? Again, the technology in question increases the chances of this situation happening, and it should be up to couples to decide.

Critical stances on reproductive liberty can be found as well. In that case, it is often opposed to other values, such as the value of human life/human dignity or public interests. The latter will come forward in later paragraphs. With respect to human dignity, one poster states:

[Person E]: *"I don't think this should be about liberty; it should be about human dignity and human dignity concerns even if it does not affect me. While some might have the right intentions & (not) want a child, because there is something inherently lesser if a certain trait would(n't) be missing there is no guarantee that others, who have the same possibility, will have the right intentions. I respect liberty, but I find human dignity to be more important."*

Person E seems to respond to a case where people might use sex selection for morally wrong reasons, such as sex discrimination. For this person, hence, the technology seems to expand our duties and responsibilities in that our choice for a specific sex must be based on the right intentions. Also, the unborn child is (implicitly) seen as a right holder whose rights are expanded by the technology, and which must be protected for intrusion for the wrong reasons. When the technology is used, it should only be in the case when couples have 'morally right' reasons.

5.2.2 Family Structure

Family balancing is often brought forward as a justification for sex selection for non-medical reasons. As such, it is connected to reproductive liberty and forms a limitation for that matter. The idea is that a family with an overrepresentation of a specific sex has the right to bring the family 'into balance' by selecting for the opposite sex. In countries where sex selection is/was temporarily allowed (for example in the U.S.) clinics often use the family balancing criterion for parents who wish to use sex-selection technology. This means that only if your family is 'out of balance', you have the possibility to use the technology.

Family balancing is an often discussed theme on internet forums, mostly from a critical perspective. As it often is presented as a justification, the debate is mostly on whether the justification is 'enough' to outweigh the other arguments, or on whether the justification is nonsense in itself: what is wrong with an unbalanced family, and why not drop the criterion? In other words, people / parents in favor of the technology find it often restrictive for invalid reasons, and people / parents against the technology find that it offers no ground to accept use of sex-selection technology. Consider the following statements:

[Person F]: *"I'm confused... why is "family balancing" a more valid criterion than any other? I have a girl, and I want another girl. A sister-bond is very important to me. But MicroSort only allows you to select for the "less represented" sex. The U.S. does not have the cultural problems India and China do, so why the restriction?"*

[Person G]: "*I find the term "Family Balancing" most offensive. I find it offensive because it's implying that the family you have is somehow wrong and needs to be fixed. Further, "family balancing" is a cheesy euphemism for sex selection. Let's call a spade a spade."*

[Person H]: "*We have an only-child, so our family is totally wobbly."*

[Person I]: "*Maar het is niet omdat je twee kinderen van het verschillend geslacht hebt dat je gezinnetje compleet is"* [It is not because of having two children of a different sex that makes your family complete]

[Person J]: "*Het gevoel van een 'compleet' gezinnetje is er niet uit het standpunt van de kinderen, maar uit het standpunt van de ouders."* [The idea of a 'complete' family is not from the perspective of the children, but from the perspective of the parents].

Person F argues that family balancing offers no more valid reasons than any of the other reasons. For this person, the composition of the family clearly has become a matter of personal choice, due to the availability of sex-selection technology. Yet, she is aware that in cultures where sex discrimination is present, it might be a different story considering the validity of the criterion. Though the technology mostly is not permitted yet, it clearly has mediated the situation already. Instead of fate, the family sex ratio is amplified as a matter of choice. Yet, when it is presented as a method to balance families, it reduces the valuable brother- and sister bonds. As such, person F seems to believe we can use sex-selection technology, but that we should not use some universal criterion on who should and who should not. There is more than one reason that justify the use of sex-selection technology, and above all reasons are context-dependent.

Person G worries that the technology will communicate a specific 'ideal' family regarding the sex ratio. Unbalanced families can 'fix' this situation by aiming for the less represented sex. Person G seems to be aware that, as the technology is able to create the family sex ratio, it *can* also mediate the idea of a perfect family (which is a situation where the sex of the children is part of the idea). This might lead to a situation where it is seen as something that is 'fair' (for example towards the children) or 'right' (for example towards society) to do.

Person H seems to make fun of the whole concept of family balancing, yet with a serious undertone. According to him/her, a balanced family suggests that it is also a more stable one. The sarcasm present in this post suggests that he does not agree. Interestingly, the whole (mediated) idea of a perfect family seems to reduce the attractiveness of the choice for a one-child or uneven numbered family. Or even worse (though not stated), it might lead to possible allegations when not chosen for a balancing of the family.

Person I and person J seem to have the same perception on what the situation *is*, and argue that other things determine whether your family is 'complete'. Above this, person J adds that the whole idea is from the perspective of the parents, and not from the children.

5.2.3 Technological Replacement

The field of tension between 'nature' and 'technology' is a recurring theme in the technological age, and so it is within the field of sex-selection technology. When in 1978 the first IVF baby was born, this was subject of fierce public debate. Nowadays however, IVF is almost completely accepted as a method for sex-selection for medical reasons. This is not to say when it is used for non-medical reasons, even though the technologies under development do not have the moral problems present with methods comparable to IVF. Consider the following posts of people on the different forums:

> [Person K]: *"I get why parents would want to select out for certain diseases, but sounds like someone is trying to play God, or trump nature and biology…creepy."*
>
> [Person L]: *"I find this all ghoulish and a very slippery slope. For now it's unethical to not choose eye & hair color, but for how long? Where does it end? Eventually undesirable skin color will be selected out."*
>
> [Person M]: *"I fear that the law of unintended consequences would take over. While I am fine with ART and IVF, I do think that mother nature usually knows best. I would rather evolution take its natural course. Besides, it ruins the surprise."*
>
> [Person N]: *"We can all discuss if it should be legal or is it ethical, but I think it's only going to become more common as technology advances and prices drop."*

Person K represents a large group of respondents that see sex-selection technology as the first step towards a designer baby. The term 'designer baby' refers to a situation where the sex of the child is just one of the

many characteristics you can choose as a parent. Technology is seen by person K as a force constantly further pervading into nature, making its processes obsolete. Considering the choice of words ('play God', 'trump nature and biology', 'creepy'), person K sees this as something absolute undesirable and would probably argue against the use of sex-selection technology.
The same holds for person L, yet the basis of his/her argument lies in the domain of discrimination. According to person L, the technology (and future technologies) can/will be used discriminatory, ruling out all undesirable characteristics. As such, we should not allow sex-selection technology as a first step.
Person M seems (at first) to not have so much problems in the specific aim of the technology, yet fears that unintended consequences will be part of its use. However, just like person K, Person M sees the natural process literally ('mother nature') knows best how to conceive (/create) a child with its specific characteristics. Moreover, the technology is a threat to natural evolution, or at least presents an alternative one (they will not go hand in hand in any case). It seems that person M would advise against the technology, though not as strong as person K. We should be careful, and probably use it only incidental.
For person N the technology is seen as an unavoidable development. Despite possible legitimate moral concerns, it will be introduced sooner or later. Hence, public deliberations and the introduction of the technology seem to be perceived as two isolated activities. Technology can pass society in its autonomous course, and discussions on the legitimacy and morality might just as well be useless. On the other hand, it is exactly (a part of) society that will be the driving force. Who will develop this technology further? Who will make use of it as prices drop? Person N hence seems to draw the line between those with moral and legitimate concerns, and those who use it (for reasonable prices).

5.2.4 Good Parenthood

The last category of values consists of values regarding the subject of 'good parenthood'. A great deal of the discussion on the matter is about the opposites of choice and fate, and the way how a good parent should deal with it. Consider for example the following statements:

[Person O]: *“First rule of parenting ~ you take what the good lord gives you. And with selfless gratitude.”*

[Person P]: *“Are we really this shallow and spoiled? You know, we all have ideals in our head of what kind of child(ren) we want, not just gender but appearance and personality. That is normal. But what makes becoming a parent a character building experience is accepting and loving the children born to you for exactly who and what they are. Children are not material possessions; they are human beings. I think taking the money you want to spend on this and investing in therapy would be a wiser decision and more helpful to your existing child(ren).”*

[Person Q]: *“family "balancing?" If YOU'RE unbalanced b/c you crave a girl so much, there's no way that adding a female to the household suddenly transform you into a normal mother.”*

[Person R]: *“Waarom zou je het geslacht van je kind kiezen? Om het aan te kleden als een etalagepopje? Omdat je hoopt dat bepaalde eigenschappen geslachtsgebonden zijn? Uiteindelijk is toch elk kind uniek en dat staat los van het geslacht."* [Why would you choose the sex of your child? To dress it like a doll? Because you hope certain traits correspond with a specific sex? In the end every child is unique from whatever sex it is.

[Person S]: *"I do think it's important to note the distinction between the rather superficial desire to choose a baby's eye color and the understandable interest in wanting a girl/boy after having 3 or 4 children of the other sex. Whenever this concept comes up, I feel like the superficial and the legitimate desires of parents always get intertwined. People who want this are not necessarily all just shallow people."*

Person O clearly has some opinions on what makes a good parent. Acceptance of your fate, and selfless gratitude. It seems that he/she has the opinion that using sex-selection technology is not used by 'good' parents. Moreover, to be able to exert the influence on the sex of the child is an active decision which this person probably would not consider as being selfless. In that case, sex-selection technology has the risk of stimulating less good parents, and clearly this is an issue. Technology, hence, also mediates the idea of what makes up a good parent.

Person P seems to be an elaboration on the opinions of person O. Choosing the sex of the child in the eyes of person 2 is equal to value them as material possessions which is shallow and spoiled behavior. No longer having 'to deal' with certain things causes a lack of character building for the parents. Hence, sex-selection technology seems to be a risk for these virtues as choice diminishes the necessary domain of this parental development, and should not be used (although not explicitly stated).

Person Q also seems to react on sex-selection technology from a good parenting perspective. In his/her eyes, having strong feelings ("cravings") for a specific sex is not 'normal' behavior, and getting the specific sex desired for will not transform the parent into a normal parent (mother). Again, it seems that sex-selection technology is seen as a threat for parental virtues, and will only be used by the 'lesser' parents (or the other way around: if you use it, you are not a good parent).

Person R questions the activity of choosing the sex, as well as the motives for the parents. Just like the previous mentioned persons, person R believes choosing the sex of the child can only be done for 'wrong' reasons (dress it like a doll, hope for sex-linked traits). The only good way to see it is that every child is unique, and should be treated that way. Hence it is wrong for him/her to choose a specific sex for the child. In this case however, the risk of using sex-selection technology is that the child is not (considered) unique (and treated that way), but a 'projection' for the parents' ideas of an ideal child.

Person S wants to break a leg for people with (in his/her view) legitimate desires. As technology gives the opportunity to choose for a specific sex, there are reasons this might be perfectly admissible (with the example of having 3 or 4 children of the same sex). In his/her eyes it is wrong to consider this as a superficial desire. Interestingly, as the technology becomes available so will this discussion on whether the desire for a specific sex is legitimate or superficial. Just like our ideas on IVF, the availability of the technology (and its mediation) might even change our conception on the legitimacy of reasons.

Another line of thought is specifically pointed to the children in question that have been conceived using sex-selection technology. Especially the situation where sex-selection technology has not resulted in the specific sex of choice. Consider these statements:

> [Person T]: *"Weten dat je ouders 6000 euro betaalden opdat je een meisje zou zijn, lijkt mij een erg zware last om te dragen als dochter [To know as a child that your parents paid 6000,- euros to be a girl seems to me as a heavy burden."*
>
> [Person U]: *"Think about how bad the third boy must feel, when his mom is devastated to find out he is male. That's like being devastated that they had HIM."*
>
> [Person V]: *"I think it's much better to do that* [to use a reliable sex-selection technology] *than to risk getting severe GD* [Gender Disappointment] *that could hinder your relationship with the baby."*

The reaction of person T and person U are related, in that they see a risk that the child will be affected by knowing his/her parents have used sex-selection technology (successfully or unsuccessfully). Person T worries that the child will experience social pressure to behave according to her gender specific role that is

connected to the specific sex. For person U, the worry is that a child will experience less acceptance or being undesirable when he/she finds out that he/she was not of the desired sex. Obviously, a preferred sex can exist whether the technology is used or not, and obviously disappointment can exist when the child is not of the desired sex. Yet, this is exactly where the mediation of technology comes in, by amplifying the connection between desired sex and outcome. Although 'gender disappointment' may exist in all circumstances, in the situation where a reliable technology is used with an unsuccessful outcome this may be even more severe.

That is implicitly also what person V argues: currently sex-selection technologies are used that are less reliable. Yet, when the sex of the child enters the domain of control and choice, and when technologies are used that are more reliable in realizing the desirable outcome, the heavier the situation might be if it turns out wrong.

5.3 Summary of Results

The objective of this Chapter was to explore which norms and values surrounding sex selection are discussed in society. What are the opinions or claims on the availability of sex selection? How do people think about its use? Which norms and values become destabilized by the introduction of sex-selection technologies? To explore this, several internet forums were analyzed to find out how people judge the 'is', 'can' and 'ought' of sex-selection technology. In the tables below, the results of the explorative analysis are presented in an overview.

REPRODUCTIVE LIBERTY	PERCEPTION / OBSERVATION
IS	- The sex of the child will become a personal choice from the parents
CAN	- The 'right sex' of the child adds to personal happiness - The decision to use the technology is a private matter
OUGHT	- If no harm is done, sex-selection technology can be used - sex-selection technology may only be used when the right intentions are involved

Table 3a: judgment of sex-selection technology in societal conversations on reproductive liberty in terms of 'is', 'can' and 'ought'

FAMILY STRUCTURE	PERCEPTION / OBSERVATION
IS	- The composition of the family is no longer a situation of fate but a situation of choice - Reasons for sex selection may be different in different situations - There is something as a 'perfect family'
CAN	- It can result in negative outcome when sex discrimination is present; - Influence our ideas of what makes a perfect family - Amplify the idea that your family should be balanced - Reduce the idea that other compositions of family are just as valuable (e.g. sister- / brother bonds)
OUGHT	- Technology should be used to balance families in terms of sex ratio - Technology should be used according to the parents' wishes - Technology should not be used for family balancing since a balance of sex is unnecessary or irrelevant

Table 3b: judgment of sex-selection technology in societal conversations on family structure in terms of 'is', 'can' and 'ought'

TECHNOLOGICAL TAKEOVER	PERCEPTION / OBSERVATION
IS	- We are on the brink between natural conception processes and technological replacement of those processes; - We are 'muddling' with the unknown, play God or interfere with Nature; - sex-selection technology is an unavoidable development
CAN	- Make the natural processes considering offspring obsolete - sex-selection technology makes (the first step) towards the designer baby possible - Stimulate discrimination - sex-selection technology will leave us with unintended consequences - sex-selection technology will develop further despite societal concerns - Create a division between those who develop/use it and those who don't.
OUGHT	- Walk away from it, and choose for God/Nature; - We should be careful when we use it: only for specific cases; - Get used to it, it will happen anyway.

Table 3c: judgment of sex-selection technology in societal conversations on technological replacement in terms of 'is', 'can' and 'ought'

GOOD PARENTHOOD	PERCEPTION / OBSERVATION
IS	- Good parents do not use sex-selection technology; - sex-selection technology diminishes virtues of 'good parenthood'; - Choosing the sex of their child can only be done based on 'wrong' reasons; - sex-selection technology is a threat in treating children as unique individuals - There are legitimate reasons to opt for sex selection.
CAN	- sex-selection technology does not stimulate 'good parenthood', but the opposite; - sex-selection technology turns the child into a 'material' possession by being able to choose the sex of the child; - sex-selection technology regards the child as not being 'unique', but a product of choice. - Prevent gender disappointment - Result in severe 'gender disappointment' - Turn a legitimate desire into reality
OUGHT	- Parents should not be able to use it since it will involve lack of parental virtues; - Parents should not be able to use it since sex-selection technology causes a lack of character building for parents; - Parents should not be able to use it as it can only be done based on wrong reasons. - Allow when the desire is legitimate

Table 3d: judgment of sex-selection technology in societal conversations on good parenthood in terms of 'is', 'can' and 'ought'

6 Anticipating Mediations of Sex-selection Technologies

In the previous chapter, empirical data was analyzed regarding moral conversations that were evoked by existing and sometimes more experimental methods of sex selection. It described some of the public deliberations on this matter, in terms of the normative and moral reactions of people involved in fertility treatments or specifically methods for sex selection. Especially in the situations where specific (moral) positions were for example valued, embraced or rejected, it shows how different values are impacted during the development and introduction of sex-selection technologies. These insights are important as they are subject in the mutual shaping between technology and society. After all, according to the theory of moral mediation, our normative frameworks are not static but co-evolve with introduction of new technologies.

From Postphenomenology, the presented role of technology is one that sex-selection technologies may influence our perception of (e.g.) the fetus/child, of reproduction and offspring and of ourselves as (to be) parents. As such, it can destabilize our current moralities and practices, and re-organization and re-stabilization occurs only when a new relationship has been found towards the specific technology. To understand this process, mediation analysis is suggested to give insight in and understanding of how specific moralities and practices are affected by the technology. The objective of this chapter is to further explore the empirical data found in the previous chapters, by looking at the way sex-selection technologies might mediate specific perceptions or interpretations, or how they may mediate specific actions in this matter.

Before continuing to the analysis, is important to realize that sex-selection technologies such as flow-cytometry and lab-on-a-chip are still in developmental phase, and not introduced to the market. There are currently methods available to choose the sex of the child, but this is still an invasive medical procedure involving several clinical activities. This complicates our analysis, as mediations for innovative sex-selection technologies are just as well the result of specific characteristics of the technology and design choices. Our perception of the situation just as well as our actions depend on the specific choices of the design and use of the technology as well. Yet, the image of a device in a home setting gives sufficient information to explore some of the possible mediations. When the technology becomes realized, the analysis should be expanded to include all mediations that come forth from the specific design and implementation.

6.1 Mediation Analysis of Sex-selection Technologies

In earlier chapters, it was concluded there are several moral dimensions/categories in the academic and public conversations regarding sex-selection technology. In the table below they are presented once more in an overview. Note that the categories the same for both domains, yet the underlying discussion has a different focus. Also, as arguments may overlap or used to defend positions in different categories, other classifications of categories can be chosen as well.

Moral dimensions from academic literature	Moral dimensions from societal deliberations
Reproductive liberty - Freedom of choice (of characteristics of children) - No harm done	**Reproductive liberty** - Freedom of choice (of characteristics of children) - Happiness - Human dignity
Family structure - Family balancing - Discrimination of gender	**Family structure** - Family balancing (of the sexes) - Creating specific compositions - Discrimination of gender
Technological replacement - Slippery slope - Interference with natural reproductive system (unintended consequences) - Technological determinism - Instrumental view on human life	**Technological replacement** - Slippery slope - Interference with natural reproductive system (unintended consequences)
Good parenthood - Desires of the parents - Consumerism - Wellbeing of the child	**Good parenthood** - Acceptance of fate/reality - Character building - Desires of the parents - Wellbeing of the child - Wellbeing of the parent (gender disappointment)

Table 4: moral dimensions surrounding sex selection: academic literature versus societal deliberations

Having chosen the dimensions for categorization, the next step is to examine how each category is impacted by sex-selection technology. In the following paragraphs, an analysis is given of perceptions and actions regarding the identified categories that are (possibly) mediated by sex-selection technology. With the use of Verbeek's postphenomenological vocabulary and the practical elaboration of Swierstra & Waelbers, this analysis gives an anticipation of possible mediations of sex-selection technologies.

6.1.1 Mediation of Perceptions and Actions regarding Reproductive Liberty

In literature, there is much attention for the possible risks of reproductive liberty, especially the tension with the interests of the child. When parents have the freedom to choose the sex of their children, will they be doing this for the right reasons? Will this be a further step towards the 'designer baby'? Are the interests of the child 'under pressure'? Regarding social conversations on reproductive liberty, it seems that people primarily respond more positively as the technology brings the sex of the child from the domain of fate to the domain of choice. It mediates the ideas and possibilities of freedom, self-determination and happiness. However, when opposing arguments such as the 'child as an instrument' or 'a healthy child is the only thing that matters' come forward, they tend to be very strong and emotional.

Moral imagination results in some very relevant and valuable insights, not discussed in either literature or social conversations. For example: knowing the sex from the beginning of the pregnancy results in an earlier or different bonding of the parents with the child. This also means we immediately shape our expectations of the future, at the same time carrying the risk that this expectation is very gender-specific. In the tables below, possible mediations from the three sources are enumerated for the dimensions of perception as well as action.

What *is* the situation? What *can* we do? What *ought* we to do?	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action) and explanation	Source	Dimension
The 'right' sex of the child adds to personal happiness	Amplification: Characteristics of the child are to be determined by the parents; the child is an 'instrument' for e.g. parents wishes or happiness.	Literature / Social practices and deliberations	Existention / Perception
The sex of the child will become a personal choice from the parents	Amplification: The choice of parents for a specific sex is based on discriminatory reasons.	Literature	
The technology is able to determine the sex of the child	Amplification: Parents have a procreative autonomy concerning the choice for the sex of their children	Literature	
The sex of the child will become a personal choice from the parents	Amplification: The sex of the child is a private decision to make for the parents	Social practices and deliberations	
The sex of the child will become a personal choice from the parents	Amplification: When your child has the sex you've chosen/wished for, this adds to your personal happiness	Social practices and deliberations	
The technology gives immediate knowledge in the preconception phase about the (chosen) sex of the child.	Amplification: We perceive the unborn child immediately with a specific sex (no uncertain period), either boy or girl, or (…)	Reason / Imagination	
The technology increases the time of knowing the sex of the child before birth. This time is 'consumed' by parents with expectations and preparations.	Amplification: By knowing the sex of the child, it immediately shapes our expectations of the future having a boy or girl	Reason / Imagination	
The technology increases the time of knowing the sex of the child before birth. In this time, the parents 'bond' with the child based on their knowledge and expectations	Amplification: The bonding of parents with the unborn child is more (sex-)specific from the start (developmental view)	Reason / Imagination	
The technology increases the time of knowing the sex of the child before birth. In this time, the parents 'bond' with the child based on their knowledge and expectations	Amplification: The bonding of parents with the unborn child might be stronger considering the fact that the period of knowing the sex of the child is longer.	Reason / Imagination	
By knowing more characteristics of the child (in this case the sex), the father may be more involved during pregnancy	Amplification: There is a possible greater linear / mutual involvement of both parents	Reason / Imagination	
The technology increases the time of knowing the sex of the child before birth. In this time, the parents 'bond' with the child based on their knowledge and expectations	Amplification: There is possible greater involvement of the parent with the same sex (choosing/knowing from the start)	Reason / Imagination	
The technology is able to determine the sex of the child	Reduction: The child is an autonomous person, or 'right-holder'.	Literature / Social practices and deliberations	
The technology is able to determine the sex of the child	Reduction: The idea that whatever the sex, the child being healthy is what counts	Social practices and deliberations	
The technology is able to determine the sex of the child	Reduction: The sex of the child is a surprise at birth (that is, when chosen not to know the sex in advance)	Social practices and deliberations	

The technology is able to determine the sex of the child	Reduction: Whether a boy or a girl, your life will adapt to the specific situation (less goal-oriented)	Reason / Imagination	Hermeneutical / Action
The technology is able to determine the sex of the child	Reduction: The idea that the sex of the child is the result of fate (or for some people possibly faith)	Social practices and deliberations	
The technology is able to determine the sex of the child	Reduction: The idea that sex and gender are two different things	Reason / Imagination	
The technology is able to determine the sex of the child	Reduction: The idea that there are intermediate positions between the two sexes	Reason / Imagination	
The technology is able to determine the sex of the child	Invitation: To make use of the technology as it is available	Social practices and deliberations	
The technology is able to determine the sex of the child	Invitation: To use the technology for discriminatory reasons	Literature	
The technology is able to determine the sex of the child	Invitation: To use the technology for non-discriminatory reasons	Literature	
The technology is able to determine the sex of the child	Invitation: To make use of the technology to increase happiness	Social practices and deliberations	
The technology is able to determine the sex of the child	Inhibition: The choice to not use the technology	Reason / Imagination	

Table 5a: Mediations of sex-selection technology regarding reproductive liberty

6.1.2 Mediation of Perceptions and Actions regarding Family Structures

Family balancing is argued as a justified reason for sex selection, yet with the condition that the wish of the parents is 'neutral', i.e. not based on discriminatory reasons. The potential risk identified in literature is that family balancing may lead to the conception of an 'ideal type' of a family, and hence restricts other types of family structure. This is acknowledged in social conversations as well: a brother- or sisterbond can be very valuable, and hence is a focus on 'balancing' the sexes is shortsighted. Arguing further from imagination, one can imagine the situation where social pressure arises to balance your family, or when an unbalanced family is seen as discriminatory behavior of the parents. Hence, sex-selection technologies tend to amplify an ideal type of family structure, whereas other valuable family-structures are reduced.

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
The composition of the family is no longer a situation of fate but a situation of choice	Amplification: The composition of a family is the result of specific choices of the parents	Literature	Existention / Perception
There is something as a 'perfect family'	Amplification: The wish of the parents is not value-free, i.e. based on discrimination of sex	Literature	
Technology should be used to balance families in terms of sex ratio	Amplification: The child will have gender-specific behaviour	Literature	

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
The composition of the family is no longer a situation of fate but a situation of choice	Amplification: There is a 'normal' or 'perfect' composition of a family in terms of sex distribution	Literature	
The composition of the family is no longer a situation of fate but a situation of choice	Amplification: The composition of a family in terms of sex distribution is a matter of freedom/choice.	Social practices and deliberations	
The composition of the family is no longer a situation of fate but a situation of choice	Amplification: The composition of a family in terms of sex distribution is a matter of responsibility or even accountability	Social practices and deliberations	
There is something as a 'perfect family'	Amplification: The idea that if there is a perfect or balanced family, we should strive for it	Social practices and deliberations	
There is something as a 'perfect family'	Amplification: The idea that the technology should (only) be used to come to a balanced family	Social practices and deliberations	
Technology should be used to balance families in terms of sex ratio	Amplification: The idea that sex-selection technology should be used to come to a 'balanced society' in terms of sex distribution	Social practices and deliberations	
The technology makes the family composition in terms of sex distribution controllable	Amplification: An unbalanced family might be the result of sex discrimination	Reason / Imagination	
The technology makes the family composition in terms of sex distribution controllable	Reduction: The idea that there are a multiple of different family compositions that are 'normal' or 'good'.	Literature	
Reduce the idea that other compositions of the family are just as valuable	Reduction: The idea that an imbalanced family (e.g. more boys or girls) has its own advantages / is just as valuable	Social practices and deliberations	
The composition of the family is no longer a situation of fate but a situation of choice	Reduction: The idea that parents might 'choose' for an imbalanced family.	Reason / Imagination	
There is something as a perfect family composition	Reduction: The idea that a balance of the sexes is irrelevant.	Social practices and deliberations	
There is something as a perfect family composition	Invitation: Selecting the opposite sex when one sex is dominant in the family.	Literature / Social practices and deliberations	Hermeneutical / Action
The composition of the family is no longer a situation of fate but a situation of choice	Invitation: Selecting for the socially desired sex	Literature	
The composition of the family is no longer a situation of fate but a situation of choice	Invitation: Making sex selection a private act of the parents	Reason / Imagination	
The composition of the family is no longer a situation of fate but a situation of choice	Invitation: Social pressure to balance your family	Reason / Imagination	

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
The composition of the family is no longer a situation of fate but a situation of choice	Inhibition: The choice for the same sex if this sex is already present in majority in the family	Reason / Imagination	
The composition of the family is no longer a situation of fate but a situation of choice	Inhibition: The decision to not make use of the technology when your family is unbalanced	Reason / Imagination	

Table 5b: Mediations of sex-selection technology regarding family structure

6.1.3 Mediation of Perceptions and Actions regarding 'Technological Replacement'

Another subject that is mentioned in literature is the fear of people that the reproductive technology replaces the natural process, and that at the same time we do not fully understand and control the whole process of reproduction. Especially in social conversations, this argument is often mentioned and seen as high risk. Next to slippery slope arguments regarding designer babies, people also fear the technology as unavoidable. From imagination, the matter or risk of seeing sex (and also gender) as only 2 possibilities on a scale. Intermediate positions ('intersexuality') are not recognized, and sex/gender complementarity may become taken more for granted.

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
The technology (partly) replaces the 'natural process' of reproduction, including the sex of the child	Amplification: We know the 'mechanics of nature' and hence can (or sometimes even should) interfere with it	Literature	Existention / Perception
We are 'muddling' with the unknown, play God or interfere with Nature	Amplification: Technology taking over the natural reproductive process is creepy, trumps biology or is equal to playing God.	Social practices and deliberations	
The technology is able to determine the sex of the child instead of this being the outcome of the 'natural selection process'.	Amplification: Artificial interventions can replace (parts of) the natural reproductive system.	Literature	
The technology makes (the first step) towards the designer baby possible	Amplification: The technology is the first step on a slippery slope, towards 'consumer' babies.	Literature / Social practices and deliberations	
The technology makes (the first step) towards the designer baby possible	Amplification: The technology is the first step on a slippery slope where discriminatory reasons will be used tot create the perfect baby in terms of all kinds of characteristics.	Social practices and deliberations	
The technology is an unavoidable development	Amplification: Regardless of what we think of it (in terms of ethics), technological interference is unavoidable.	Social practices and deliberations	
The technology (partly) replaces the 'natural process' of reproduction, including the sex of the child	Reduction: The idea that there are intermediate positions between the two sexes (transgender)	Reason / Imagination	
The technology (partly) replaces the 'natural process' of reproduction, including the sex of the child	Reduction: The idea that sex and gender are two different things (diminishing the expectation of possible bisexuality or homosexuality)	Reason / Imagination	

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
The technology (partly) replaces the 'natural process' of reproduction, including the sex of the child	Invitation: To replace the 'natural course of things' with a technological support in reproduction by choosing the sex (even if there is no strong preference)	Reason / Imagination	Hermeneutical / Action
The technology (partly) replaces the 'natural process' of reproduction, including the sex of the child	Inhibition: Leaving the sex up to chance/fate, not using the technology	Reason / Imagination	

Table 5c: Mediations of sex-selection technology regarding technological takeover

6.1.4 Mediation of Perceptions and Actions regarding Good Parenthood

Finally, in the discussions analyzed there is a strong connection between the use of sex-selection technology and good parenthood. Again, the fact that sex-selection technology brings the sex of the child into the domain of choice rather than fate is the basis of these discussions, but in this case this is confronted with conceptions of what a 'good' parent is or should do. In literature arguments are presented regarding the behaviour of good parents: unconditional love and acceptance (regardless of the child's characteristics), creating an open future and environment so that the child can 'flourish'.

Interestingly, in social conversations even more attention is given towards good parental behaviour. Acceptance and the necessary character building when dealing with your fate (i.e. raising a boy or a girl) are seen as virtuous behaviour from a parent. On the other hand, there are people who argue that it should not be considered as just shallow desires. As such, the mere presence of sex-selection technology mediates (already) what is seen as good parenting. It seems that the choice of a specific sex results in the discussion whether or not you are a good parent when making use of this technology. From imagination then, one can image how deviation from these ideas may become seen as bad parenting.

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
The technology is able to determine the sex of the child according to the parents' wishes.	Amplification: The sex of the child is one of the first characteristics that can be 'ordered', and may lead to consumerism.	Literature	Existention / Perception
The technology is able to determine the sex of the child according to the parents' wishes.	Amplification: A child should behave according to its sex (gender-specific behaviour)	Literature	
The technology is able to determine the sex of the child according to the parents' wishes.	Amplification: As parents look for ex-specific traits, they discriminate against the other sex	Literature	
The technology is able to determine the sex of the child according to the parents' wishes.	Amplification: The child has no open future, but is part of a technological 'destiny'.	Literature	
There are legitimate reasons to opt for sex selection	Amplification: The difference in a superficial desire for a certain sex, and a profound wish after having multiple children with the same sex.	Social practices and deliberations	
The technology is a threat for treating children as unique individuals	Amplification: There is a social pressure on the child to behave gender-specific knowing that his/her parents spend a considerable amount of money for him/her having a specific sex	Social practices and deliberations	

What the technology 'does' (or 'can do')	Type of mediation (amplification/diminishing of perception or invitation/inhibition of action)	Source	Dimension
Choosing the sex of the child can only be done on the basis of 'wrong' reasons	Amplification: Good parents do not use sex-selection technology	Social practices and deliberations	
The technology is a threat for treating children as unique individuals	Amplification: The technology turns the child into a material possession.	Social practices and deliberations	
There are legitimate reasons to opt for sex selection	Amplification: There is a difference in legitimate and non-legitimate desires	Social practices and deliberations	
The technology is a threat for treating children as unique individuals	Reduction: Love and acceptance towards your children is unconditionally	Literature / Social practices and deliberations	
The technology diminishes virtues of 'good parenthood'	Reduction: Acceptance of fate leads to character building as a parent	Social practices and deliberations	
There are legitimate reasons to opt for sex selection	Reduction: Gender disappointment as a result of the child having the 'wrong' sex.	Social practices and deliberations	
The technology is able to determine the sex of the child according to the parents' wishes.	Invitation: Selecting the sex of the child for 'wrong' reasons, i.e. consumerism	Literature	Hermeneutical / Action
The technology is able to determine the sex of the child according to the parents' wishes.	Invitation: Larger involvement of both of the parents	Reason / Imagination	
The technology is able to determine the sex of the child according to the parents' wishes.	Invitation: Larger involvement of other people close to the family	Reason / Imagination	
The technology is able to determine the sex of the child according to the parents' wishes.	Invitation: Making the choice a subject of deliberation with partner, family and friends	Reason / Imagination	
The technology is able to determine the sex of the child according to the parents' wishes.	Inhibition: Choosing the sex already dominant in the family, as this might be seen as bad parenting.	Reason / Imagination	

Table 5d: Mediations of sex-selection technology regarding good parenthood

The results presented in the tables show there can be a vast amount of information identified regarding the mediation of sex-selection technology. In the next chapter this will be used to answer the question whether mediation analysis can be a valuable addition to the current assessment of sex-selection technology.

7 Contribution of Mediation Analysis

In the previous chapter a mediation approach was used to anticipate specific technological mediations of sex-selection technology. These mediations were differentiated in terms of amplifying or diminishing certain perceptions, and inviting or inhibiting certain actions. In this chapter, the question is answered if and how mediation analysis can contribute to the existing assessment sex-selection technologies. First, the results found with mediation analysis are connected to differences in the earlier described assessment methods. Second, it is analyzed what differences can be found between academic literature and social conversations (including moral imagination). Then, an overview is given of the moral questions that result from the mediation analysis of sex-selection technology, and how they different from the ones identified in literature and the current assessment of sex selection in the Netherlands. Finally, the question is answered whether and how mediation analysis can be a valuable contribution to the existing assessment of sex-selection technology and to contemporary methods for technology assessment in general.

7.1 Different Moral Issues identified in Academic Literature and Mediation Analysis

In table 4 (chapter 6), the moral categories and the differences in moral issues within these categories have already been reflected on. As it turns out, the moral dimensions spoken of in literature correspond largely with the moral categories form public conversations. Within these categories however, different moral issues may be addressed, or different interpretations of moral issues can exist. Also, using moral imagination may result in other anticipations of mediations and possible moral issues involved. Although this is not the place to perform a full assessment of sex-selection technologies, there is however something to say on the ethical issues identified in academic literature compared to the ethical issues resulting from the mediation analysis. In the paragraphs below, differences in identified moral issues are given on the partial conclusions of these assessments.

7.1.1 Moral issues regarding Reproductive liberty

In academic literature, reproductive freedom is presented as the most important justification for allowing the use of sex-selection technology. The justification however must satisfy the condition that no harm is done to the child, and that the wish for sex selection is not based on discriminatory views of the parents. The Dutch Health Council also argue that sex selection is not inherently discriminatory, neither inherently damaging to the emotional development of children. As such, they argue that there are no principle reasons to advice against the introduction and use of sex selection technologies. According to the Dutch Health Council, these rights can however be limited when balanced against other relevant values or the interests from relevant stakeholders, such as the rights of the child.

In public discussions, the matter of increased happiness of the parents is mentioned as a valuable interpretation of reproductive freedom. When parents have a strong desire for a specific sex not based on discriminatory reasons, this may add to their happiness (and hence can be an argument to use sex selection). Further, using moral imagination, mediation analysis unfolds that the technology may increase the expectations of parents of gender-specific behavior, as they (probably) involved their expectations of this in the choice for either of the sexes. Moreover, with the choice of either a boy or a girl, these expectations become limited and enforced exactly to be either of the two. Sexuality however is not a binary characteristic, but two ends on a scale. On this scale exist intermediary positions as well, with the most known position to be that of homosexuality or transgenders. When the technology will be widely available, this might have consequences for their acceptation by their parents as well as acceptation in society.

7.1.2 Moral Issues regarding Family Structure

According to some literature, *if* sex selection is allowed (for example based on procreative rights), then it should only be allowed to balance the number of persons with a specific sex in the family. The main argument for family balancing is to prevent sex discrimination regarding the family structure, and to prevent an imbalance of the sexes in society. The latter is of course only relevant if a stronger preference in society exists for either of the sexes. Arguments mentioned against family balancing as a criterion for sex selection are based on the promotion of a restrictive idea of a family. In contrast to historical conceptions, our liberal societies have developed a nuanced and differentiated interpretation of a family structure, whereas sex selection (again) promotes an 'ideal kind' of a family. This promotion does not match with the societal values, and hence is outdated and ethically inappropriate (according to some authors).

Within public conversations, there is also a lively discussion on family balancing. Many people do not agree with this criterion, which is currently often used in countries where sex selection is allowed (though strictly regulated). Whereas in academic literature it is referred to as a possible valid reason for sex selection (if not coming forth from discriminatory viewpoints), in public discussions it is often argued against or even ridiculed for they see the family balancing argument as not being sound. If the discrimination criterion is met, it should also be perfectly fine if someone chooses the same sex for their succeeding child(ren). Whereas in academic literature the counterargument is that family balancing could result in an interpretation of an ideal type of a family, the family balancing argument is mostly fully rejected in public conversations. If there is no underlying discriminatory reason, parents should have the freedom to choose the family composition parents wish for. Although in public discussion it is sometimes agreed with academic literature that family balancing as an argument for sex selection could amplify the idea that there is an ideal type of a family, it is also mentioned that the technology regulation could possibly reduce the idea that other compositions have their own value (such as strong brother- or sisterbonds).

From moral imagination, other relevant anticipations come forward as well in the mediation analysis. As the technology brings the family composition to the realm of choice instead of fate, the perception might be enforced that every family composition is the result of the specific choices of the parents. In that case, this composition might become seen as a responsibility of the parents, and even something parents are accountable for. Suppose family balancing restrictions will not be issued, and a family has an imbalance in the sexes: will this be seen as sex discrimination? Is a societal pressure to balance your family to be expected? The question that rises is whether it will be accepted when parents do *not* make use of the technology even if they meet all the criteria required.

7.1.3 Moral Issues regarding Technological Replacement

The replacement of natural processes by technology is something that is occasionally mentioned in academic literature, yet is considerably often discussed in public conversations. From both domains, though described differently, the argument is one of risk and control: as we do not fully understand the natural reproductive system, aren't we risking all sorts of problems (like genetic defects) with our offspring? In the public conversations, this argument is often brought in a more general form. There is the idea that we live in a growing technically construed society, where technology replaces all kinds of 'natural' processes. For many this is felt as a threat: are we able to control these forces of technology? Although there are also some others who interpret the growing presence of technology as an increase of their freedom, this feeling of potential technological 'dominance' is one to take seriously considering its magnitude.

One argumentational structure that is regularly used (in academic literature as well as in public discussions) in this respect is the 'slippery slope'. For example, if we allow the sex of the child to be chosen by the parents,

this will only be a first development in choosing all kinds of characteristics of the child: eye-color, length, or more sophisticated characteristics such as creativity or musicality. Or, in a more substantive shape, if we allow fiddling with nature with respect to our sexes, the end is loose for technology to replace the most fundamental natural processes of reproduction. Behind this latter argument lies the conviction that 'natural' is (generally) better than 'technological'. Interestingly, the argumentation of a slippery slope is actually a partial acknowledgement that moral change (decline) will occur when the technology is introduced. The limitation of its use however is that it is used almost always in a negative sense: the slippery slope argument is brought forward as a situation that if we allow the technology to be introduced, it will be a first step on a road we should not go, towards an end or destiny we do not want to be (which brings us back to 'moral presentism').

From mediation analysis, moral imagination leads to some other insight of a different kind as well. As was already identified under the category of 'reproductive freedom', the natural way of reproduction can result in intermediary positions between the two sexes as well (e.g. transgenders). Regarding the category of technological takeover, the technological mediation could result in a reduction of the idea that sex and gender are two different things, for example when the expectation of possible bisexuality or homosexuality is diminished.

7.1.4 Moral Issues regarding Good Parenthood

The moral category of good parenthood (or what behavior a good parent should have regarding sex selection) comes forward in both literature and public conversation, yet misses in the assessment of the Dutch Health Council. The availability of sex-selection technologies seems to result in specific ideas (or additions to existing ideas) of what makes a parent a 'good parent', and especially in what situation the use of the technology is 'legitimate'. Although some arguments are brought forward in literature, it is certainly not the main reason against (as it mostly is) sex selection. The main objection in this respect is that sex selection is incompatible with the virtues of a good parent. The child should be accepted with unconditional love, and using sex selection to determine one of its characteristics is seen by some authors as treating the child as a consumer product.

In public conversation, these parental virtues are subject of fierce debate[105], and compared to academic literature it is discussed much more extensively. Just as in academic literature, the arguments are mostly all phrased in a negative sense: virtuous parents would never choose for sex selection. We will lose some virtues or character traits we would have developed if the sex was left to fate. Our lives move in a specific direction depending on what fate (or 'God' for some people) has in store for us, and the acceptance of this may lead to character building, and (eventually) in happiness or a good life.

Moral imagination in the mediation analysis however leads to quite some additional material of moral issues to consider. With sex-selection technology, we can actively shape a part of our future in taking the sex of the child and the family composition in our own hands. We can deliberate and discuss the use of the technology and the sex of the child in advance with our partner, or maybe even with family and friends. A well-considered choice and the realization of a wish might just as well lead to the happy and fulfilled life. Also, sex-selection technologies mediate our ideas of the (soon to be) children and the relationship of parents towards them. We perceive them immediately with a specific sex which also influences the relationship towards them in different ways. As parents know the sex from the beginning of the pregnancy, the perception of the child is

[105] This may also have to do with the fact that on these for a people with fertility problems meet with people who wish for a specific sex. For the first group this is a very hard wish to imagine when possibly there is no chance of a pregnancy at all.

more concrete (with a specific sex), and so are their expectations of their future with it. The bonding of parents with their child might be stronger, especially since the child has the sex the parents wished for. Also, both parents may be more mutually engaged, as they both share the images and the decision of the specific sex. These anticipations possibly make the technology more valuable for the parents, but also for the child(ren). There is also the moral issue identified regarding genderspecific behavior of the child. Specifically choosing for a specific sex might result in less acceptance when the child displays behavior that is not gender-specific. This may result in pressure towards the child due to disappointment from the parents.

7.1.5 Summarizing: Additional Moral Issues Identified with Mediation Analysis

The existing assessment of sex selection and the results of a mediation analysis show differences in their results. The analysis between academic literature (current assessment of sex selection) and the results from mediation analysis show there are a number of moral issues that were identified by mediation analysis yet not by academic literature. In the table below, they are presented once more in an overview.

Moral category	Additional moral issues identified
Reproductive liberty	- Increased happiness of the parents - Perception that sexuality is binary, possible problems with acceptance of 'intermediate' positions.
Family structure	- Why should sex selection only be used for family balancing? - Family balancing may lead to undervaluation of brotherbonds and sisterbonds - Parents might be seen as responsible for the specific family composition, and possibly accused of discrimination if the family is 'unbalanced'.
Technological takeover	- Reduction of the idea that sex and gender are two different things.
Good parenthood	- A well-considered choice for having a child of a specific sex. - Stronger bonding with the child due to earlier engagement in the pregnancy - A more balanced and mutual involvement of both the parents - Perception that sexuality is binary, possible problems with acceptance of not gender-specific behavior. - Pressure for the child to act according to his/her gender.

Table 6: moral issues identified by mediation analysis not identified previously in sex selection technology assessment.

Note that the mentioned moral issues are not a full overview of the result of the mediation analysis, it presents only the moral issues not identified in academic literature. The question that remains, and which is the main question of this thesis, is whether mediation analysis is a valuable contribution to the assessment of sex-selection technology, and whether it can be a valuable conclusion to technology assessment methods in general. This will be topic of the next paragraph.

7.2 Mediation Analysis – a Valuable Contribution?

This thesis started with a critique on current methods of technology assessment, as (is claimed) they focus mostly on only the consequences of the introduction of the technology in question, and also typically on the 'hard ones'. The presupposed role of technology results in a view where society and technology are two separated or isolated domains. As such, they are said to overlook the impact on society and its morality, and especially the mutual shaping of technology and morality. Mediation analysis is proposed as a way to understand this relationship between technology and morality, and also to anticipate on soft impacts of

technology. Is this critique indeed correct with regard to the assessment of sex-selection technology? What can we learn from the mediation analysis of sex-selection technology? And, following the main question of this thesis, can mediation analysis be a valuable contribution to contemporary ethical assessments of technology?

7.2.1 Results of Mediation Analysis

From the previous paragraph, based on chapters 5 and 6, it is clear that mediation analysis results in more relevant material for assessment that was not identified in the current assessment of sex-selection technologies. This would not necessarily mean that the outcome of the assessment procedure would be much different. Yet it could mean that specific moral issues would have led to different regulations or legislation. With the current full ban on sex selection for non-medical reasons in the Netherlands, it is less obvious this would have been the case. But suppose sex selection is legally allowed for family balancing reasons. Arguments such as the value of brother- or sisterbonds could possibly lead to a more nuanced approach to possible discrimination of the sexes. Also, although we do not yet know exactly the outcome or rate of success of the technology to determine the gender, it could lead to an early awareness that the acceptance of minorities such as intersexuals or transsexuals possibly become compromised.

These additional insights are the result from empirical analysis of societal deliberations and moral imagination with regard to technological mediation. Yet, the question is whether it is true that in the existing ethical assessment moral issues are overlooked as the result of the isolated interpretation of the domain of technology and the domain of society. In other words, is it true that the impact of technology on morality was not identified in the current assessment? If one looks at the arguments from literature on for example possible shifting norms with regard to family composition, it seems that the impact of technology on this specific subject is indeed accounted for. Also, looking at counterarguments with regard to reproductive liberty such as the slippery slope on the characteristics of our children we would like to determine, it seems that changing morality is considered a possibility (although it seems to be used only negatively). Following these examples, one could say however that the presupposed relation between technology and society is regularly confused. It is however not the case that the mutuality of technology and morality remains totally unidentified. However, to be specifically aware of the mutuality of this relation does possibly lead to moral issues that would have remained unidentified otherwise, as the mediation analysis of sex-selection technology shows. The conclusion hence can be drawn that Verbeek is correct in his claim regarding the fact that the mutual shaping of technology and morality is not specifically accounted for. Yet, his claim might be nuanced a little bit more, as it is not necessarily the case that all moral issues resulting from this specific mutuality remain hidden. To identify the remaining moral issues however, the conclusion that mediation analysis results in a valuable contribution compared to the existing assessment can be fully agreed upon. This is not only with regard to the identification of moral issues connected to the application and/or availability of the technology, but also with regard to the understanding of how exactly technology and society are intertwined, and how this can be used to assess the technology in question.

In the paragraphs below, this understanding of the relation between technology and society as well as the value for technology assessment is elaborated on. A distinction is being made with regard to the type of anticipation, the understanding of the dynamics of ethical frameworks and the moment and role for ethics in assessing new technologies.

7.2.2 Anticipation, Speculation and Mediation

Anticipation of technological impact is an important part of the technological assessment. Yet, anticipating on possible impact runs the risk of being speculative, i.e. that we get ahead of the case and describe a future

that necessarily does not have to become reality. Nordmann describes this in is infamous article on speculative ethics as the 'if-and-then statement'[106]: a possible technological development is taken (the 'if'), and then consequences of this development are presented ('then') as something almost inevitable. According to Nordmann, this speculatory form of reasoning is often used as a mandate for specific action. Yet, as the future that is being presented is not at all a certainty to happen, the mandate for action is quite wobbly. Nordmann does not claim that speculation is a wrong thing to do however. It should be an informed procedure though, based on solid foundations.

When we compare mediation analysis with methods for assessment described earlier in this thesis, it seems that the type of speculation differs substantially between the methods. Palm & Hansson (eTA) have a critical stance towards any predictions or speculations in technology assessment. Their idea of eTA is that it should not be used to see as far into the future as possible, but to 'investigate continuously the ethical implications of what is known about the technology under development[107]. Yet, by relying on a predetermined checklist, the question is whether this investigation represents the real ethical impact of the technology in society. Although limiting the horizon prevents free-floating speculation, the used values (checklist) for anticipation may not align with the present social values and decrease the reliability of the anticipations. With regard to the method of Technomoral Change, building scenarios for anticipation could just as well be judged as a form of speculative ethics. However, to put limits to the speculation, the framework that is proposed has some anchoring in historical analysis. Although modelling and evaluating anticipations based on patterns from previous ethical debates might increase their reliability, one could still argue that the method essentially is another form of speculative ethics.

With mediation analysis however, the amount of speculation is substantially lower. The reliability of the anticipation of technological impact is increased by studying the impact of the technology on society 'real-time'. After all, the information for analysis is coming from public deliberations on the values and practices which are impacted by the technology in question. And althought this may not count for using moral imagination in identifying technological mediations, understanding the mechanism how technology results in moral change through mediation adds to the reliability of the anticipations. As such, it presents a different technique to anticipate human-technology relations that finds its basis in empirical information. That said, this empirical basis for speculation about the future means that it is only possible for technologies that are at the threshold of society. To be sure, if the technology is still unknown, its impact on society and the practices and values of individuals and groups will be minimal.

7.2.3 The Role of Ethics in Technology Assessment Methods

Another characteristic where mediation analysis differs from the other assessment methods mentioned is the moment of the technology assessment itself. Somewhat exaggerated, the classical approaches place this moment for assessment at the end of the developmental process, right before the technology enters society. In that case, the desirability of the technology is judged with a simple 'yes' or 'no'. According to Verbeek, the role of ethics is like that of a boarderguard, protecting society from potential harmful technologies[108]. This interpretation of ethics in technology assessment seems to be underlying eTA as well, although a more iterative process of technological development and technological assessment is proposed. The checklist can be used as an 'early warning system', and any technological potential that is conflicting with one of these values indicates the need for ethical evaluation. In the design process, this information can be used to modify the technology or to inform decision-making on the introduction of the specific technology. As concluded earlier in this thesis though, the values that are presented in the checklist remain fixed, and hence ethics still

[106] Nordmann (2007)
[107] Palm & Hansson (2006)
[108] Verbeek (2011)

used for the protective 'yes or no' decision. The approach of Technomoral Change is not so much focused on the technological developmental process, but focusses on possible (soft) impacts of new technologies on society. As technologies result in moral change, according to Boenink et al., especially policymakers should be aware of this interaction between technology and morality. Hence, their approach seems to focus on the decision-making authorities that allow for specific technologies to be developed or introduced in society, and hence seems (at least partly) to go together with the interpretation of ethics as a boarderguard as well.

Mediation analysis is presented as an alternative to existing methods of technology assessment, with a different role for ethics. This role, Verbeek calls an 'accompanying role', ethics should actively inform the design of the technology by bringing forward mediation possibilities in the design that can contribute to a 'good' design and introduction in society. As a result, according to Verbeek, ethics is no longer a border guard that judges' technology to be 'right' or 'wrong', but actively accompanies technology design to come to beneficial human-technology relations. At first sight, it seems this is not so different from eTA, where ethics is used in the design process as well. On second thought however, it is different in that the subject of the ethical analysis is not so much the values of technology that may collide with the values of society, but the technological mediations that come forward from the design. Besides designing technology with ethics, the concept of mediation proposes the opposite as well: we can occasionally steer morality with technology. By ruling out negative mediations, and by including positive mediations, it is (to some extend of course) possible to design society as well.

As was explained before, anticipating on possible technological mediations can be done by empirically examining the actual impact of technology on existing morality, or by moral imagination. When to choose between either of the two? It may be clear that it is not very useful to analyze social deliberations when the technology in question is unknown in society. If mediation is a designing activity then, this would also mean that in the beginning of the design process the designer is more subjects to his own moral imagination. Of course, to increase the quality of the anticipations, he could for example make use of focus groups, etc. Yet, as the amount of speculation seems higher with moral imagination, it seems logical to presume that further down the stages of development and design of the technology, the process should less rely on moral imagination, and more on empirical information. Mediation is no alternative to speculation, it partly still relies on it, yet it may be different throughout the process.

Also, the representation of the assessment methods above might presume a linear model of technological development, where the technology nicely goes sequentially through every stage of development. In reality, this does not necessarily have to be the case. Some technologies, or technological concepts are introduced in society and keep on developing producing all kinds of tranches of innovations. Their development might also be less controlled as the assessment methods seem to suppose. A concept as mediation might be especially of value in those circumstances, as it approaches ethics as something that develops alongside with technology. There never is a formal 'yes or no' moment to decide on the social desirability of the technology. The developmental process of the technology is not always nicely orchestrated, and hence the role of ethics should be just as flexible as well. This also means that it depends on the specifics of the developmental process of the technology in question in how much mediation as a concept can be of additional value.

7.2.4 Understanding the Dynamics of Ethical Frameworks

The concept of technological mediation is especially helpful in understanding how morality changes over time under the influence of technology. Although the approach of technomoral change also makes us aware of this fact, it does not answer the question *how* technology does so? Of course, increasing the number of choices and the resulting responsibilities (and resulting moral issues) is one side of the coin. But where mediation analysis is really helpful is by understanding the mechanism of how specific concrete technologies

change our perspective and our morality for that matter. Specific developments on the micro level (a specific technology) can ultimately end in changing moral frameworks on the macro level. A famous example of Annemarie Mol is the birth control pill: although its meaning on the micro level might simply be to prevent a pregnancy, on the macro level it was very important for the emancipation process of woman, but also of gays and lesbians by disconnecting sex and reproduction[109]. The mediation approach not only makes it possible to anticipate and reflect on technological mediations, it also helps to understand how meaning is given to the technology and how the technology changes moral frameworks.

Interestingly, not only do our moral frameworks develop alongside with the technology, we assess technology by making use of exactly the same moral frameworks that are in development themselves subject to the technology in question. Take privacy as an example, what we mean by it, and our morality underlying it, changes almost every day as technologies are continuously developed that ask for a specific understanding of the value and a specific relationship towards the technology. Before the enormous developments in Information and Communication Technology, privacy was quite a straightforward value, and maybe even one that was not so much on the surface of our everyday lives. Yet, alongside the developments in ICT, it became a very important, multi-faceted and personal value which meaning often needs an urgent new interpretation or action as we are confronted with new technologies that impact this value almost every day. As such the morality of privacy as a value is developed in practice, or 'on-the-fly'. At the same time, it is used to 'mold' the technology further for example by restricting it or making it support our current conceptions of privacy, or to develop specific regulations for application. So, the meaning of privacy changes under the influence of technology, and by using this value to asses new or emerging technologies, the meaning of the technology itself is changed as well.

Finally, if specific technologies and moralities are coproduced where the one is not guarded by the other, aren't we wasting our time with analysis of these social deliberations and argumentations? After all, the claim could be possible that if we wait long enough, every technology (with its co-existing morality) will be allowed[110]. From the mediation point of view, as technology is able to change our moral frameworks, it also influences the way we think about the good life as well. It can change our perceptions of what it means to be a human being in this world, and what we belief is 'good' for ourselves and the world. We can learn how specific technological characteristics result in specific changes in our moral frameworks. By making mediation analysis part of the technology development process, it can be used for evaluation by the designer, but also by the public or politics. It also means that ethics is no longer viewed as the border guard that protects society against 'bad' technology. Rather, it becomes a helpful perspective in the design process and assessment process how to come to technologies that help us come to a good society and a good life.

[109] Verbeek (2011)
[110] See for example Dondorp & de Wert (2012), where the authors seem to suggest that the whole public deliberation phase can be skipped as in time the technology will be available after all.

8 Conclusion and Discussion

The aim of this thesis has been to answer the question whether a mediation analysis of technology could be a valuable addition to existing technology assessments. To answer this question, an analysis of a specific technology (sex-selection technology) is used for analysis.

Currently, the use of sex-selection technologies is not allowed in the Netherlands. Only when there are severe medical risks involved (e.g. sex-linked genetic diseases) it is allowed to perform sex selection. An analysis of literature and the assessment of sex selection for non-medical reasons in the Netherlands shows that currently arguments based on the rights of the child as a stakeholder, slippery slope arguments and arguments based on an instrumental view on human life weigh more heavily than arguments based on reproductive freedom.

Mediation analysis has its roots in Postphenomenology which promotes a different perspective to the relationship between technology and the human being, as well as between technology and morality. Values and (moral) practices may change as the result of the mediation of a specific technology. Yet, current assessment methods seem to focus on 'hard impacts', ignoring the influence of technology on our everyday practice and morality. As such, the soft impacts of technology are overlooked in the assessment procedure, as well as the mediatory role of technology.

An important part of mediation analysis is the studying of the impact of technology on practices and values in society. In contrast to other approaches which focus on the ethical part of the technology assessment, mediation analysis uses actual information found in discussions within society. Regarding sex selection, several discussions on internet were analyzed to explore and examine soft impacts and possible technological mediations. From this analysis, it was concluded that the identified main moral categories by the public overlapped with literature and existing assessments. Yet, there were also moral issues identified within these categories that were not accounted for in literature. These moral issues were the result of specific mediations of sex-selection technology. An analysis of the moral mediation of sex-selection technology results in more relevant material for the assessment, which consequently results in valuable and relevant questions to take into consideration, for example: how does the technology mediates the child during pregnancy, and possibly changes our relationship towards it? How does it not only mediate a specific conception of a family-structure, but also creates social values in whether- and how parents should use the technology? Mediation analysis makes these moral questions and concerns visible. As such, they can be food for thought and deliberation, and analyzed and used by technology-developers and policy-makers.

Based on the differences in result between academic literature and mediation analysis, it is argued that a mediation analysis of technology is valuable to include in (or added to) contemporary assessment methods to increase its scope for analysis. Also, it is argued that the insights in the way sex-selection technology mediates should be used throughout the development of the technology. This way, 'good mediations' can be created, and 'bad mediations' can be ruled out. As such, the technology assessment results in not simply a 'yes' or 'no', but is used to design 'good', or desirable technologies.

The findings in this thesis corroborate with the theoretical argumentation from Postphenomenology that an instrumental view of technology results in a limited scope for (ethical) technology assessment. When the mediatory role of technology is not accounted for, relevant moral issues could possibly be overlooked in the assessment procedure. Examining possible mediations of sex-selection technology added to the existing body of identified moral issues, and occasionally resulted in a refinement or more nuanced view of already

identified moral issues. As such, it strengthens the conclusion that it is valuable to add mediation analysis to contemporary technology assessments.

The implication of the findings in this thesis are relevant for assessment agencies to take notice of. To acknowledge the value of mediation analysis might also lead to the adaptation of current methods to include a mediation analysis as part of the assessment procedure. Yet, acknowledging for the active and mutual relationship between technology and society could result in a different interpretation and role of ethics in technology development. From Postphenomenology it is argued to not place the ethical assessment at the end of the technology development process, but rather use its insights throughout the technological development process. During the development of the technology, mediation analysis can give relevant information for the design of the technology, for example suggesting specific mediations to be added to the technology design or possibly undesirable mediations to be ruled out.

As there currently is no specific methodology for mediation analysis, and there are no other mediation analyses performed, it is not possible to relate these findings to other studies. Hence, further research is advised to accumulate to the general conclusion that mediation is a valuable addition to contemporary technology assessments. Also, to further test the validity of this conclusion, it might be useful to perform a mediation analysis of a technology that already is adopted by society, and evaluate whether the identified mediations in reality indeed have caused a shift in certain values and practices involved.

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Internet forums:

http://www.dcurbanmom.com/jforum/posts/list/15/301257.page

Key words: "Microsort", "Gender Selection", "Family Balancing", "Sex Selection"

http://fertilethoughts.com

Forum Section: Family Balancing (Gender Selection).

http://forum.zappybaby.be

Forum section: "Preconceptie". Key words: "Microsort", "Geslachtsselectie", "Family balancing

http://www.ingender.com/forum/

Search on threads containing "ethics" and "ethical" (no search function in Forum, search by use of Google function within websites).

Youtube:

https://www.youtube.com/ watch?v=zNoM--mBbC0 - *Gender Selection - 60 Minutes with Dr Daniel Potter*

https://www.youtube.com/ watch?v=KdULpD8u93g - *How To Have A Girl - Gender Selection In America*