Anthropo-Ethical Rules for the Human Zoo

OR

Under what social, political, and existential conditions can the human influence human evolution by means of CRISPR/CAS from an anthropo-ethical perspective?

Master thesis

Institution: University of Twente, Faculty of Behavioural, Management, and Social Sciences, Enschede, the Netherlands

Programme: Philosophy of Science, Technology and Society

Date: 21-08-2017

Supervisor: Prof. dr. ir. P.P.C.C. Verbeek

Second reader: Prof. dr. C. Aydin

Student: Ruud van Laar

Student number: s1026496

Summary

In this thesis I focus on the possibility of engineering the genetic material of humans in order to influence human evolution. The possibilities of CRISPR/CAS raise questions about ethics, anthropology, evolution, and technology. In this thesis I aim to find out under what social, political, and existential conditions, the human can influence human evolution by means of CRISPR/CAS from an anthropo-ethical perspective. I will argue that to understand CRISPR/CAS, and to be able to properly appropriate it in its relations to human, we must do so from an 'anthropo-ethical' view. This view combines human self-understanding with a morality that is connected to it. This is necessary because CRISPR/CAS, as an 'evolution technology' does not only mediate our moral self-understanding, but also our anthropological self-understanding.

I look at the bioethical discussion of liberal eugenics for answers and argue that, for an ethics of humans and technologies, their understanding of human-technology relations is insufficiently explicated. I criticize this discussion on two points. First, for lacking an anthropological understanding of the human being. Second, I build on postphenomenological criticism that both sides in the discussion presuppose a fundamental split between humans and technology, while an evolution technology such as CRISPR/CAS is specifically questioning the existence of that separation. What I require is a clear anthropology that acknowledges the human relation to technology.

I take a look at the philosophical anthropology of Bernard Stiegler, which I use as an anthropological basis which connects to a normative perspective on technologies, from which CRISPR/CAS9 will be analyzed. I argue that, although the analysis of CRISPR/CAS from his theory is fruitful, it does not lift us out of the bioethical standstill. I will show a weak connection between his anthropology and his too-specific normative stance regarding technologies and argue that he is too pessimistic. This causes him to be stuck in a singular perception of a right temporal mode that does not appreciate the human condition of finding himself falling in technics, that he himself has put forward, making him a 'human-technology relation conservatist'.

Finally, I combine Stiegler and postphenomenology to address the critique on Stiegler, and the critique on postphenomenology that it is not able to come a normative stance regarding our 'accompaniment' of technology, because this is lost in relativity. This leads to the conclusion that the influence of human evolution by means of CRISPR/CAS must happen within the condition in which the human understands himself as a being in relation to technology, and uses this insight to responsibly shape himself, within which he needs to hold on to his perspective in which he understands himself as a technologically mediated being. But this can only happen within a mediated political, social and existential self-understanding, to which I attach no truth-claim.

Foreword

I have hay fever and I find it highly frustrating to be allergic to my biological environment. I am not only frustrated in a physical sense, for which my pills alleviate the worst of my symptoms. I feel that my technical environment is enclosing me to the extent that my biological roots are fading. I fear that, although my pills keep me seemingly healthy, my biological self is losing a battle I should not want it to lose. A battle of nature versus technology, where the fast and easy methods of prosthesis will turn out to allow my biological core to decay, hidden from sight. I see this not as a dynamic of my individual life, but in the scheme of a slow process that neglects any biologically evolutionary advantages because prosthesis are more efficient. If possible, I would like to engage in a process of biological evolution that will turn this neglect of our biological core around.

However, any 'traditional' way of evolution implicates a continuous fierce competition for the chance to reproduce, which would result in an undesirable social system. Luckily, the same biotechnical development that allowed us to neglect our biological core, is now opening up the possibility to make alterations to that core. It is the paradoxal form of this solution that I have found very interesting and has led me to choose it as the subject of this thesis. Near the end of writing this thesis I figured I may have (had) ulterior subconscious motives for this specific subject of evolution.
I noticed that my interest in the self-shaping and the freedom to do so perhaps did not apply only to the genetic, but extended to the shaping of my own future as well. How do I responsibly shape my own future? Within what conditions can I pursue my own growth? And how should I go about it?

Just to prepare you, I have found the balance between writing excitingly – to make sure the reader is not spoiled to soon and wants to keep reading to find an answer to the next question – and to write clearly – to make sure the information is presented insightfully and easy to oversee – hard to maintain. So whenever you encounter something that you find vague, there is a big chance it will be explained within a few pages.

Finally, I would like to thank all the people who have helped me getting through the process of writing this thesis. To all the friends from Ideefiks, Kronos, Aragao, 'old-skool', my housemates, the 'afstudeergroep', or wherever I found you, and of course Thuy: thank you for being there. And thanks to the great advice and remarks from prof. dr. Ciano Aydin – my second reader – and the many meetings with prof. dr. Ir. Peter-Paul Verbeek – my supervisor – which combined al lot of insight, motivation and happy laughter, this thesis has been made to what it is today. Thank you all and have fun reading!

Contents

Chapter 1: The maelstrom of Evolution, Ethics, Anthropology, and Technology.

Progress might have been all right once, but it's gone on too long.

- Ogden Nash *in* 'Come, Come, Kerouac! My Generation is Beater Than Yours' (Nash, 1959)

The advance of biotechnologies opens up new ways to understand ourselves. Recent breakthroughs in genetic engineering technologies – CRISPR/CAS9 in particular – merge biological and technological reproduction. The boundaries between humans and technologies seem to blur when our reproduction – the means by which we perpetuate our existence (as a species) – takes place through technological intervention. 'The reproductive system' may lose its meaning as a description of our biological reproductive organs and start to relate to the bio-industrial system that is used when we create new life.

The traditional dynamic of parenting has always been a repetitive system in which parents make decisions for their children until these children are mature enough to make their own decisions. Then this new generation begets children and the loop continues. However, the development and availability of technologies that can be used to genetically modify the next generation's bodies seem to breach this perpetual loop of parenting. The possibility to alter a genetic make-up is not a choice that lasts a lifetime, but a choice that lasts through all generations – or until someone overwrites it with another choice, which requires technological intervention.

CRISPR/CAS9 raises the question how to morally give shape to ourselves as a species, or to shape each other as individuals. The difference in these perceptions – shaping ourselves or shaping each other – brings forth a collision between evolution and ethics. When we describe these processes as "shaping ourselves to fit better in our environment" it seems evolutionary advantageous, but when described as "shaping others to fit within a world of our choice" the goal of designing humans becomes questionable.

In the essay 'Rules for the human zoo' Peter Sloterdijk questions if we should make rules to guide the use of technologies that have an effect on human reproduction. He asks: "What can tame man, when the role of humanism as the school for humanity has collapsed?" (Sloterdijk, Rules for the Human Zoo: a response to the Letter on Humanism, 2009) Sloterdijk relates to Plato's 'The Statesmen' in which Plato argues that a good king must also look into the breeding of his subjects: "Royal anthropotechnology, in short, demands of the statesman that he understand how to bring together free but suggestible people in order to bring out the characteristics that are most advantageous to the whole, so that under his direction the human zoo can achieve the optimum

homeostasis". The 'rules for the human zoo' suggested by Plato should be the ones that are most beneficial to the whole, although 'rules' may be an inadequate description because Plato also emphasizes that these people must be free. The current genetic applications offer new tools for the 'herding of men' and as goes with all technological development; we won't be able to stop it. Sloterdijk gives a good description of the irresistibility of new technoscience:

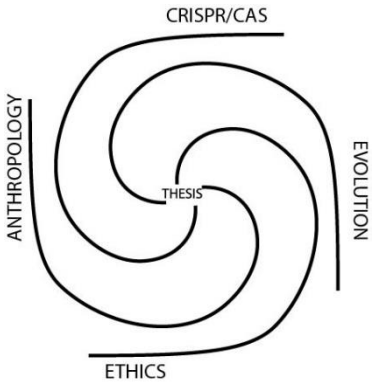
> "But, as soon as an area of knowledge has developed, people begin to look bad if they still, as in their earlier period of innocence, allow a higher power, whether it is the gods, chance, or other people, to act in their stead, as they might have in earlier periods when they had no alternative. Because abstaining or omitting will eventually be insufficient, it will become necessary in the future to formulate a codex of anthropotechnology and to confront this fact actively." (Sloterdijk, Rules for the Human Zoo: a response to the Letter on Humanism, 2009)

Although Sloterdijk was merely posing the question that advanced biotechnology raises, he has been criticized for instigating a new age of (Nazi-) eugenics by bioconservatives as Jurgen Habermas. (filosofie.nl, 1999). But what is the alternative? Do nothing? If this technology can change human beings on such a fundamental level, should we not want to consider to guide the use of this technology in the direction that benefits humankind? But this biological evolution must be accompanied within a social, political, and existential self-understanding. In this thesis I aim to find a way to pursue, and influence, a deliberate course of human evolution. I will argue later in this thesis that it is of fundamental importance to understand the relation of technology to the human, to ethics, and to anthropology, which happens in the philosophy of Bernard Stiegler and the area of postphenomenology. Therefore, my research question is:

> *Under what social, political, and existential conditions can the human influence human evolution by means of CRISPR/CAS from an anthropo-ethical perspective?*

The prospects of new technologies such as CRISPR/CAS9 question the boundary between humans and technology and, as Sloterdijk argued, pose us for the question of how, and if, humanity should 'herd' itself. Fundamental changes like these urge us to question our understanding of the human, and in extension, question what that anthropological understanding means for what makes a good life. We now possess technologies to influence the path of our evolution, which is already questioning what we understand as evolution. All in all, concepts of ethics, evolution, anthropology find themselves in an interdependent maelstrom with CRISPR/CAS as depicted in the picture below.

In order to answer my research question I will first need to understand the relation between the concepts of ethics, evolution, technology, and anthropology. This first chapter servers as an introduction in which attempt to understand the questions that CRISPR/CAS9 raises on the concepts of evolution, anthropology, ethics, and technology, and their relation to one another, in order to understand the depth of the disruption CRISPR/CAS brings. The goal of this chapter is to find out how evolution, anthropology and ethics can be tied together for the analysis of CRISPR/CAS in order to provide the structure for the rest of this thesis.



In order to fully understand this maelstrom in which evolution, CRISPR/CAS, ethics, and anthropology collide, I have divided this chapter in three parts.

In the first part of this chapter I explore the combination of technology and evolution. On the one hand, technological interventions complicate the 'simple' systems of evolution, while it is because of the process of our evolution that we have come to these technological interventions. How should we then understand ourselves – anthropologically – in relation to our biology and our technology?

In the second part I move from an evolutionary perspective to an ethical one and address several questions concerning normativity and evolution. I will question the possibility of ethically evaluation of evolution technologies. Can we even ask ethical questions about evolution? Should we not leave ethics out of these processes because evolution will find its own way by its natural processes? But if the subjects of these evolution technologies are humans, are we not obligated to make some rules so that they are not subjected to immoral treatment?

In the third and final part of this chapter, I will emphasize the need of a perspective that integrates both concepts of anthropology and evolution. The struggle between the desire for progress and the incentive to act justly will be evaluated. How can the connection of these two terms be understood? Can we have an 'ethics of anthropology'? Now technologies can penetrate us to the level of our reproductive system, and if that happens unwillingly, should we call that 'anthropological rape'. Or perhaps an 'anthropology of ethics' in which we are understood as fundamentally ethical? Or is there another possibility to connect these views?

1. Evolution and Technology

In this section, I will investigate the relation between Evolution and Technology. How are technologies used to influence our evolution? And how should we understand evolution if it is technologically determined instead of by the random processes of nature? How should we even understand ourselves?

I first look at Darwin's evolution theory and the problems that poses for human evolution. Then I will look into several practices and technologies that have been of influence on human reproduction, and therefore are part of our evolutionary process. I use the term 'evolutionary technologies' to describe "Technologies whose intended use have an impact on the distribution of genetic material". Finally, I look at how we can understand our evolution in relation to technology.

Evolution

Darwin's famous book with the full title '*On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life'* describes how species gradually change over time through the process of natural selection. (Darwin, On the Origin of the species, 1859) By means of random mutations, some individuals of a group have a higher chance on survival than others, leading to a statistical process in which those creatures that have the characteristics that result in the best combination of survival and reproduction will statistically do so. This process, in which the unfit perish and the fit thrive, is better known as the 'survival of the fittest'. This dynamic of nature is necessary to keep a healthy and strong population that sufficiently changes along with the fluctuations of its environment – evolving as it is called. In Darwin's theory, 'natural selection' is an important mechanism of evolution, which implies that technological – artificial – selection is something different. However, in Darwin's time the only possibility of evolution was by means of natural selection, but that does not have to mean the only way of evolution, or adaptation, can happen by means of natural selection. A different definition of evolution states: "Evolution is a process that results in heritable changes in a population spread over many generations." (Laurence, 1993) I would like to continue with adapted version of this definition for three reasons.

Firstly, by being ambiguous about the 'process' the use of biotechnologies such as CRISPR/CAS can be included. Secondly, by specifically using the term 'population spread' this definition requires that heritable changes are shared by at least a part of a population. Thirdly, it does not speak about 'favored' or 'better' specimens, but only changes. The adaption I propose concerns omitting the last three words, which imply that an evolution process can only be called so, if heritable changes happen 'over many generations'. For example, a recent study of killifish in polluted rivers has shown that these processes can happen quite fast if the population is large and covers a large genetic

diversity. These fish have undergone major adaptations to live in highly polluted water in only 60 years. (Page, 2016) Furthermore, I wish to include the use of technologies that can alter the genetic make-up of a species within the course of few generations. So I'm left with: "Evolution is a process that results in heritable changes in a population spread" in which I consider 'heritable changes' to be of genetic nature.

This definition is also open to a Lamarckian interpretation of evolution. Lamarck opposed Darwinian evolution with the idea that an organism can pass on characteristics that it has acquired during its lifetime to its offspring. Recent studies have shown that humans have certain on/off switches in their DNA that can be enabled or disabled as a reaction to the environment environment. (Enriquez & Gullans, 2015) In that sense, the events of the life in an organism can be passed on genetically. This epigenomic process uses chemical compounds that regulate the frequency of expression of a certain gene. This implies that there is more to evolution than just random mutation. It implies that the environment in which an individual lives also has an impact on the heritability of expressed genes.

Aside from this 'natural' Lamarckian evolution through epigenetics, technologies enable a form of artificial Lamarckian evolution. Our technological environment can be seen as an exo-somatic characteristic that we acquired during our lifetime, and which can be passed on to the following generation. Until the possibility of genetic engineering, the passing on of our exo-somatic characteristics and our biological characteristics were fundamentally separated. Now however, with CRISPR/CAS, our technological characteristics can be used to pass on new biological characteristics.

Human Evolution

Although Darwin's book focused on the evolution of animals, Darwin could not refrain from concluding that humans were part of the same evolutionary process. However, the 'problem' with human evolution is that man has his environment largely under control and therefore lacks natural forces of selection. Does this result in an early stop of biological evolution of the species or have we already reached the apex of our potential? If humans are subject to an evolutionary process, the human population must also know a process of 'survival of the fittest' and if nature won't be the cause of selection, then artificial selection must do the job.

The first ideas about humans influencing the course of their own evolution started in the time of Charles Darwin. Darwin's 'Origin of the Species' caused a paradigm shift in the way people saw the role of the human in the world (Berra, 2008). When people stop to see themselves as fundamentally different from the animals on the planet, they may draw more parallels between animals and men.

For example, the way in which they breed. Darwin notices that humans do things quite differently from animals. In “The Descent of the Human” he writes:

> “With savages, the weak in body or mind are soon eliminated; and those that survive commonly exhibit a vigorous state of health. We civilized men, on the other hand, do our utmost to check the process of elimination; we build asylums for the imbecile, the maimed, and the sick; we institute poor-laws; and our medical men exert their utmost skill to save the life of every one to the last moment. There is reason to believe that vaccination has preserved thousands, who from a weak constitution would formerly have succumbed to small-pox. Thus the weak members of civilized societies propagate their kind. No one who has attended to the breeding of domestic animals will doubt that this must be highly injurious to the race of man. It is surprising how soon a want of care, or care wrongly directed, leads to the degeneration of a domestic race; but excepting in the case of man himself, hardly any one is so ignorant as to allow his worst animals to breed.” (Darwin, The Descent of the Human, 1871, p. 168)

Darwin does not consider it wise – from the point of view of a breeder of man – to let the most unfit individuals procreate. Now the title ‘Descent of the human’ gets a double meaning. Not only does it refer to the human as a descendant of ape ancestors, it also refers to the decline of quality – degeneration – of the human species. However, Darwin does not stare blindly at the improvement of the human stock for the sake of improving the human. He is afraid of what ‘breeding’ would do for the deterioration of humanity as a whole. He continues:

> “The aid we feel impelled to give to the helpless is mainly an incidental result of the instinct of sympathy, which was originally acquired as part of the social instincts, but subsequently rendered, in the manner previously indicated, more tender and more widely diffused. Nor could we check our sympathy, even at the urging of hard reason, without deterioration in the noblest part of our nature. The surgeon may harden himself whilst performing an operation, for he knows that he is acting for the good of his patient; but if we were intentionally to neglect the weak and helpless, it could only be for a contingent benefit, with an overwhelming present evil. We must therefore bear the undoubtedly bad effects of the weak surviving and propagating their kind; but there appears to be at least one check in steady action, namely that the weaker and inferior members of society do not marry so freely as the sound; and this check might be indefinitely increased by the weak in body or

> mind refraining from marriage, though this is more to be hoped for than expected." (Darwin, The Descent of the Human, 1871, pp. 168-169)

Darwin withdraws from the idea of letting 'nature take its course' and stop protecting the weak. A third understanding for 'the descent of the human' makes an entrance here: that of the possible deterioration of our humanity. For Darwin, we can only hope for a disinclination to reproduce from their side, which is already encouraged by the social structures of that age. These struggles are also represented in this thesis. On the one hand, we do not want to limit the freedom of another person while on the other hand, this will result in the fact that other persons are being brought into the world with a limited physical freedom, because of their genetic constitution. While the limiting of one person's freedom only lasts one lifetime, the limitations brought along with 'bad' genes may last several lifetimes. To which extent must we expect for technologies and social structures to make up for what we lose in genetics? CRISPR/CAS may be able to help to revert this process, by breaking the germ line, it can help generations to become less dependent on technologies and social structures to compensate for their physical ills. But will we really become less dependable on technologies when we depend on a technology to become less dependable on technologies? Allowing a technology to come so close to our biological origins, what does that say about the creatures we are?

Evolutionary Technologies and reproductive systems

Many technologies and cultural practices that have influenced the way we breed. Even without specific governmental pressure on certain individuals to continue or stop their reproduction, there are policies and social practices and constructions that indirectly influence the dynamic of human reproduction. Changing this appeal for different demographics results in a different demographic of society's offspring. I will provide a short overview of evolutionary technologies, which I understand as "Technologies whose intended use have an impact on the distribution of genetic material" and practices in order to place CRISPR/CAS in a narrative of similar practices. These technologies address not just moral actions outside of ourselves but involve quite literally what we make of ourselves: they are part of an evolutionary dynamic. All these – and more – technologies and cultural or social practices have an impact on the diversity of the gene pool of the human species.

The first are social influences that prescribe how humans 'ought' to reproduce, which includes staying with one partner your whole life, and the amount of children that is socially accepted. (K-reproduction over R-reproduction)

Secondly, the state is active through financial stimuli such as child benefits, availability of public health care and subsidized daycare, which makes the decision to reproduce relatively more interesting for those who would otherwise have trouble to afford it.

Third, the spreading of knowledge about reproduction plays a role in the contemporary dynamic of reproduction. By increasing our understanding, sexual education gives us the mental tools to transform pregnancy from a coincidence into a choice – a choice to be made wisely.

Finally, a wide variety of available technologies influence reproduction. There are contraceptive technologies which prevent couples from getting pregnant such as the condom and the contraceptive pill, but also communication and transportation technologies that can bring people from different geographical areas together, allowing a higher rate of the mixture of typically geographically located genetic material. On the opposite side of contraceptive technologies, there are 'pro-ceptive' technologies such as In-Vitro-Fertilization (IVF). Some technologies can go even further than saying 'yes' or 'no' to biological reproduction. Abortion can be considered as a late form of 'contraception'[1], but as a form of selection as well. In the first case any child is not wanted in the situation, while in the second case a fetus is aborted because of its specific characteristics. A different type of selection is possible with IVF in combination with pre-implantation genetic diagnosis (PGD), in which case several fertilized eggs are diagnosed for genetic traits, after which a suitable egg is chosen.

It seems that our human evolution has been moving from a biological process to a socio-technological process, and is still doing so. New biotechnologies keep influencing our ways to reproduce, changing the balance between biology and technology and even question the very existence of a difference between the two. CRISPR/CAS9 is such a technology: instead of the selection of complete sets of DNA it can target specific genes. We won't have to *select* the most suitable, we can just *design* it.

CRISPR/CAS

In 2012 the best evolutionary technology so far to modify genetic material with unprecedented accuracy was published: a method using the CRISPR/CAS9 system. (Jinek M, 2012) In the 1980's researchers found repetitive pieces of palindromic DNA with some filled space in between the repetitive parts in various bacteria, hence the name "Clustered Regularly Interspaced Short Palindromic Repeats", or CRISPR for short. This turned out to play an essential role in the immune system of bacteria. The spaces in between could be filled with DNA that was unknown by the

[1] Although it doesn't really count as *contra*ception when it happens after reception

bacteria and work as a memory bank for its RNA. This way, when the bacteria recognizes a virus, RNA that is produced from the CRISPR part of the bacterial DNA connects with a CAS9-enzyme.

Together they localize the part of the viral DNA that matches with the RNA from the CRISPR, and the CAS9 enzyme cuts the viral DNA, rendering it harmless. (Doudna and Charpentier 2014) This mechanism has been taken up and used to target and cut DNA of other organisms than viruses. A simple overview of CRISPR/CAS9 technology at work is depicted below.

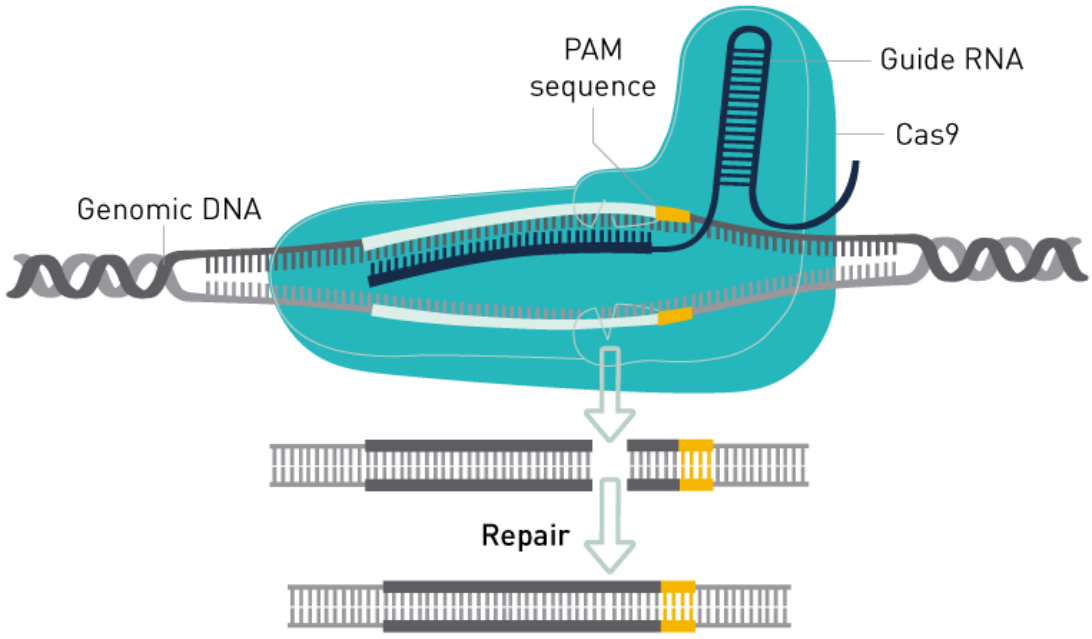


Image retrieved from: https://www.diagenode.com/en/categories/crispr-cas9-genome-editing

When this technique is applied on human DNA, the combination of a piece of guide-RNA – provided by the 'storage system' of CRISPR – and the CAS-protein view the human DNA as if it were viral DNA . When a strand of nucleotides is found that matches the strand of guide RNA, which has a typical length of about 20 nucleotides, the CAS-enzyme disables that piece of DNA by cutting both strands of its helix. The broken pieces of DNA will attempt to repair itself, so if alternative parts of DNA are introduced that fit right in the cut-out part, the broken strands of DNA may repair themselves with this new alteration in place. If the original DNA only had a 'fault' in it, it could also suffice to use CRISPR/CAS to cut the unwanted part of the DNA out, without introducing alternative DNA, while still rendering that faulty piece of DNA useless. (Ledford, 2016)

In recent years, many studies have reported use of this technique. (Sander & Joung, 2014). The implementation of CRISPR/CAS could revolutionize the human reproductive systems. Instead of the several options made available by PGD, our complete genetic makeup would become a matter of choice. However, this choice will only be opened by the advance of technology and seems to oppose biology with technology. All former technologies and practices allow the random recombination of nature to occur, while CRISPR/CAS takes a step beyond the biological and enables to make decisions of biological constitution on the most fundamental level. Technology, then, acquires a new role in human evolution. The 'old' technologies only provided the environment for reproduction and selection, but by means of CRISPR/CAS we can select what we (re)produce. What will this mean for the way we anthropologically understand ourselves in relation to biology, technology, morality, and evolution? Can we still understand ourselves as biological beings when we technologically determine our DNA? Are we crossing some moral line by crossing the germ line? Can we still call this 'evolution' if we take so much control into our own hands?

How to understand evolution in relation to technology?

Technology and evolution seem to be simultaneously composing and opposing each other. The advance of technology improved survival and reproduction rates because this prosthetic buffer allows for better fitting in the environment. However, this 'fitting' is not due to a better genetic disposition but merely an external quality, prosthesis. We have now arrived at a point of such technical sophistication it is hard to see the difference between (1) Technology as the human evolutionary advantage and (2) Technology having replaced the natural process of evolution. In the first conception the process of evolution is still on top and always overshadows whatever we do or become in relation with technology. The second position holds that technological progress is limiting human evolution by limiting biological evolution because we are continuously improving our prosthesis instead of our bodies. For both positions there is something to say: Through science and technology we do have the power to replace or reform many processes that would have happened through random combinations, yet there are still many unknown biological processes that influence evolution.

Take the example of cooking food. While the human benefits from cooking technology because it is less dangerous when most bacteria are dead, cooking technology improves because humans who adapt and improve their cooking technology have a higher chance on survival. The downside of cooking technology is that humans are now badly equipped against many diseases and bacteria because the use of many natural defenses has been nullified by the advance of technologies that make this defense obsolete. The human with cooking technology as a system has improved, but the

human – if he can be seen separately from his technology – has become dependent and worse of his own. The question remains whether biology and technology are a composition or an opposition. If CRISPR/CAS9 technology works as well as we would like to, we may have found the technology that can repair the damages in our biology that were caused by its dependency on technology. A technology that eliminates our need for other technologies or just a step further down the rabbit hole of dependency on technologies?

If technologies such as CRISPR/CAS9 achieve their potential, we could consider ourselves as having reached a new stage of evolution. A stage where the biological and the technological can both develop without standing in the way of the other. But can we still call that evolution? Does it count as evolution if the 'process' of evolution is a technological one? On an anthropological level, what does it mean that we can only make such alterations with the aid of technologies? The boundary between humans and technology is put to question when technologies can (partly) bring forth (partly) humans. Does this mean we are fundamentally technical beings? Or are we fundamentally nothing different from technologies; is there no qualitative difference between humans – and perhaps even all of biology – and technologies? In that case, it seems that CRISPR/CAS enables a new form of Lamarckian evolution because events that happen in the lifetime of an individual can definitely influence what genes are passed on to the next.

The availability of CRISPR/CAS9 confronts us with new questions regarding the 'self-herding of man'. We have already seen that human reproduction is strongly interwoven with technologies, even putting the boundary between human and technology into question. These evolutionary technologies pose the anthropological question of what we are in relation to technology. Are we biological beings with an essence that should not be touched? Or should we use technologies to make the best of ourselves and is there nothing sacred in our biology? Or perhaps we should understand our 'biology' differently, in the sense that technology has been our evolutionary advantage. Although it is unclear how technology relates to our biology, it is clear that we must understand our anthropology to understand the effects of CRISPR/CAS.

2. Evolution and Normativity

CRISPR/CAS is questioning our understanding of the relation between evolution and ethics. On the one hand we can see morality as the pinnacle of evolution. The human lifted out of the animal realm because we have a sense of right behaviour towards one another, rather than following our instincts. On the other hand, our morality may be holding back our evolutionary potential if it prevents the use of evolutionary technologies. Is our morality standing in the way of future happiness? Or is there a moral value in evolution? Is the pursuit of evolution a good thing? In this section I aim to find out how our understanding of evolution, normativity, and anthropological self-understanding is challenged by CRISPR/CAS.

I will start with a discussion of 'the way of going about eugenics'. I will give a short history of eugenics to understand why – although it seems like an honourable cause – eugenics is often accompanied by negative sentiments. This is partly to situate this thesis in a historical context and partly to emphasize that I do not aim this thesis to be an extension of early- 20th century eugenics. Second, I turn to the topic of evolution itself as a normative concept. Is there something good in the desire to evolve? And is the act of influencing this evolution something that can be good? Thirdly, I turn the second question around and look at normativity. What defines what is good? And how does our conception of the normative evolve, specifically in relation to the development of technologies that provide continuously new options to act. Finally, I will reflect on the understanding of evolution, ethics, and anthropology. With the availability of CRISPR/CAS these terms now find themselves in a difficult position.

Eugenics

From the perspective of the user – who I understand as the person(s) who order the use of this technology - CRISPR/CAS technology enables the possibility to determine what sort of people we will breed in the future. When we talk about breeding, we soon talk about taking decisions over which human characteristics are good, desired, or 'fitting'. We find ourselves talking about eugenics, which is described by Francis Galton as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally" (Galton, 1908). It is often understood as the art of 'well breeding'. This poses questions for the eugenic use of CRISPR/CAS: If there is 'well' breeding there is likely also 'unwell' breeding, but how can we know which types of breeding are right and which types are wrong. And are we talking about the product of the breeding process or the breeding process itself that is well or not? Can an unwell breeding process lead to a well creature or can a well breeding process lead to the creation of an unwell being? Which of the two – the breeding process or the breeding product – is more important?

Thinking in terms of breeding puts 'evolution technologies' and practises in a new light. Are their evolutionary effects just side-effects of social programs or should we make rules to guide them, for the sake of our 'self-breeding'?

20th Century Eugenics

Unfortunately, Darwin's call for humanism was not as well received as his theories on the 'herding of men'. 'Darwinism' has been frequently used as an excuse for genocide in the 20th century in the name of eugenics. It was Darwin's cousin, Francis Galton, who started the eugenics movement with the aim of breeding better humans. This elitist movement – in which even Darwin's children participated – turned to achieve exactly that what Darwin called "an overwhelming present evil" in the former part of this chapter. For example, Margareth Sanger, feminist and founder of 'planned parenthood' was sympathetic to the eugenic movement. She was a defender of segregation between the fit and the unfit, abortion, infanticide, sterilization, and abolishing charity for the 'weak' of society. (Latson, 2016) After all, wouldn't it be hypocrite if man were to dominate all of nature, but leave the governance of himself up to chance?

Eugenic ideals were not only carried by individuals. In the first part of the 20th century, eugenic programs were active in a large part of western societies. In Sweden, France, Austria, Finland, Norway, Switzerland and the USA, ten thousands of minorities, addicts, mentally weak, prisoners, and epileptic individuals have been sterilized – or worse – in the name of eugenics (Benedictus, 2002). The eugenic movement lived its heyday in Nazi Germany where Adolf Hitler, inspired by American eugenicists, executed the most elaborate eugenic program known in history. Leaving Darwin's call for humanity – or at least his call to value human lives – aside, Hitler shows himself as a true eugenicist in the following quote from Mein Kampf:

> "The demand that defective people be prevented from propagating equally defective offspring is a demand of clearest reason and, if systematically executed, represents the most humane act of mankind. It will spare millions of unfortunates' undeserved sufferings, and consequently will lead to a rising improvement of health as a whole". (Hitler, 1925)

If we ignore the lack of recognition for individual human lives, Hitler means the best for the human species as biological beings. After all, if we look at ten generations in the future, what pain would be remembered and how could it possibly weigh up to the pain prevented until eternity? Just to be certain, I'm not trying to defend 20th century eugenics. I'm merely trying to show that if the ideal seems right but there are only limited means to reach it, perhaps none of these are acceptable. This logic is exactly what Darwin was afraid of when he stated that it 'could only be for a contingent

benefit, with an overwhelming present evil'. In this overview of eugenics, it has come forward that individual physical quality and social quality of humanity are opposing each other.

Despite its dark history, eugenics only means 'well-born' or 'well-bred'. The ideal of creating a (human) species with the least suffering as possible does not seem inherently wrong only because the path that was taken in history was not the right one. Certainly now new technologies and practises may offer another path we must look close to determine if this path is really that different and if so; is this new path to eugenics not damaging humans and humanity in a new, unforeseen way?

Eugenics in the 21st century

After the abolishment of eugenic programs in the western world, some practises have continued for different reasons, such as individual freedom. For example, the legislation of (liberal) abortion, although not a part of any eugenic policy, is having a major effect on birth rates. Currently, overall abortion rates in the U.S.A. are declining while the abortion rate of the poor is rising. (Institute, Induced Abortion in the United States, 2017) A study by the Lozier Institute concludes that when abortions are included in Medicare, it is expected abortion rates would increase. (Lozier, 2015) This combination of policy and available technology will have an influence on future demographics. For example, 49% of the abortions in the United States in 2014 have occurred in the part of the population that is beneath the federal poverty level, although this group only makes up for 15% of the population. (Institute, Characteristics of U.S. Abortion Patients in 2014 and Changes Since 2008, 2016) Depending on the reasons for allowing abortion, we could say we are still executing some form of eugenics, certainly if we use income levels to qualify some 'quality of stock'. In the case of pre-natal screening and PGD we can even look at defects in genetic code or embryonic development. Now that abortions are legal, it could be deemed unethical to refrain from abortion or implantation when the foetus shows serious defects. Several 'wrongful life' lawsuits have already resulted in the compensation of someone who, according the legal system, should not have been brought to life because he or she has been born in a human-unworthy body after diagnostics pointed at the danger of continuing pregnancy. (FindLaw) This example shows that the availability of prenatal diagnostic technologies are already mediating our perspective on what we can expect from our offspring, and even what minimal physical constitution our offspring is expecting to receive from its parents.

Opposed to the early 20th century these abortions are not a part of a larger program but are individual decisions made by prospecting parents. As a consequence, 21st century abortions are not understood as eugenic but as a movement of liberality, yet they still have an impact on the 'well breeding' of humans. These decisions do not have the improvement of the biological constitution of

the species in mind, but the quality of individual lives of the child or parent(s). Although both seem correlated, the driving force between the same actions in both century is quite different. Eugenics in the 20th century could be divided in positive eugenics, which is about encouraging or forcing people to reproduce, and negative eugenics, which is about discouraging or prohibiting people from reproduction. But how can we see CRISPR/CAS9 in the light of these terms? Nicholas Agar refers to this development in his similar-named book as 'Liberal Eugenics'. (Agar, 2004) Liberal Eugenics seems ethically ambiguous because it neither prevents nor enables reproduction. In other words, not the quantity of offspring is addressed but the quality – or at least its perceived quality. These subtleties were not possible in less technologically advanced eras. What does this mean for the possibility of moral appreciation or rejection of CRISPR/CAS technology?

Evolution as a normative concept

A problematic subject in the pursuit of evolution, is the claim that it makes life better. I will divide this in two parts. First is about the normativity of having a 'better' body, the 'prize' of influencing evolution, which I understand as 'absolute evolution'. Second I look at the normativity of the *pursuit* of Evolution, which is not about *being* better but *becoming* better, the 'chase' of evolution, which I consider as 'relative' evolution.

Absolute evolution

Absolute evolution assumes that certain bodies are better than others – although this does not mean the persons inhabiting those bodies are better. It presupposes that whatever it means to 'live a good life' can be improved upon by having a better body, that can be reached by influencing our evolution. I think the safest way to go about this, is to consider that being 'healthy' is a part of living a good life. Although what we consider as health or disease is a contested topic. What we consider as a disease is often said to be socially constructed, but how can we know if the individual needs to be medicalized to the social norms that form our understanding of a disease, or is it the social norms that need to be addressed that falsely consider something to be a disease?

In Jonathan Sholl's 2014 Dissertation 'Evolution and Normativity', he uses the work of Georges Canguilhem to define a 'naturalized normativism' which understands health and disease as something both biologically given and socially constructed. This way, the anomalous is distinguished from the abnormal by 'using the criteria of whether a given variation allows a given organism to survive in its environment', instead of pre-determining a certain species-norm. So it is only relative to environmental pressures and forces that a digressive trait can be understood as a 'disease', and so no fixed understanding of a species should play a role in the normative evaluation of a trait. According to Sholl:

> "Health is the organism's maintenance of its organizational (robustness) and physiological (flexibility) capacities amidst changing demands, either internal or external. Conversely, disease was defined as a set of processes resulting in an unstable constriction of an organism's norms, i.e. its organizational and physiological capacities in its environment." (Sholl, 2014)

In this definition, being healthy is not only about fitting in a static environment, but also about being able to react to dynamically changing environment. In this understanding, adaptability is a feature of health, and something intrinsically good. The thing with humans is that we already have the ability to adapt our environment. Even if our biology is not that adaptable, our technology makes us very adaptable. In understanding what we consider as 'adaptable' for the human being, we require an understanding of how fundamentally technological we consider the human being.

Relative evolution

However, living in a healthy body is not the only property of a good life. I assume it also matters what one does with the possibilities that body enables. In the relative case, it is the *pursuit* of progression of the human (as a species) that matters. In that sense, the point of human life is in trying to best ourselves. It is then not really important to attain some absolute best, human life is in the effort to reach the other side, but not in reaching the other side. All 'improvement' is relative, there is no pot of gold at the end of the road of human enhancement, it is the pleasure of walking the road and being the Nietzschean 'tight rope walker' that is the pot of gold itself. The courage to wander into paths unknown is what sets apart the overman. In this relative sense, the point of using CRISPR/CAS is the fulfillness we gain while working to improve ourselves, while the actual improvement is of no value. The fact that one's genes are more efficient in itself is irrelevant because life is not about *being* better but about *becoming* better.

But these are usually only efforts that matter within the scope of an individual life, the point seems lost when one uses his life effort to 'improve' the physical disposition of the next generation because that does nothing to improve the relative case. This is then merely a call to apply oneself in life, perhaps in the science of genetics, but not a normative argument for influencing evolution.

Ethics of using CRISPR/CAS

A second interpretation is not about the form of the chase of evolution, but its content. Although it seems hard to argue that the *chase* of evolution itself is good. We can still think about *good ways of chasing it*. By intervening in DNA, we would allow humans and technologies to intervene in the

biological foundations of another human. This new field in which we can act, calls for an understanding of moral behavior in this field. Although we would not accept one living adult doing the same thing to another without consent, genetic intervention for the unborn is an unresolved area. A zygote is neither considered to be a full human nor completely unhuman. Would our acting be wrong when it is only potential life that is altered instead of fully grown human beings? What should we think of a technology that is designed for the alteration of something that is potentially a human being, but not quite yet? Do we celebrate it for its capacities to increase the potential for that human being, or do we shun it because it steps across a sacred line? And if we do not principally object the use of CRISPR/CAS, are there pragmatic uses that are good or objectionable? Would it matter if one is genetically predisposed to live a life that is more specialized or, because of a plural design of his faculties, can choose out of more options in which direction one wishes to develop himself? Does the second option encompass a larger adaptability? And is a plural body therefore, speaking from a 'naturalized normativism', a better body?

For example, in 'Human Dignity 2.0: Beyond a Rigid Version of Anthropocentrism' Sorgner argues for a 'plurality of goodness' in reaction to the normative understanding of genetic engineering. (Sorgner, 2013) According to him, everyone should be free to choose the characteristics for their own offspring, resulting in a large genetic diversity. Since we cannot know which characteristics or genes will turn out to be better 'fitting', the best thing for the species would be a plurality of genes so that we are best equipped to face the unknown. Much like the killifish that managed to adapt quickly because of their genetic diversity. But would plurality as the norm not be as arbitrary as some other subjective ideal? If we are different for the sake of being different, then is that not the same as being 'good' for the sake of some absolute good? The killifish do not control their environment as much as we do, so would our case not be different because we would create beings that do not fit in an environment that we also create.

On the other hand, it seems fair to each unborn individual that they all have the same chances to develop themselves in life. This would not ask for a plural design of the total of beings, but a plural design for each individual being, so that everyone is as free as can be to develop himself in the desired direction. This could correspond with Sen's capability approach. (Sen, 1989)

Royal Anthropotechnology: rules for the human zoo.

If we find some uses acceptable and other uses not, it would make sense to make laws to guide the use of this technology, and in extension, to guide the influencing of human evolution. These laws can be understood as 'rules for the human zoo'. However, because of our 20th century history, governmental programs that have the aim of producing 'fit members of society' are highly problematic because they are easily connected with totalitarian tendencies and the rejection of the

'unfit'. We find it important as a society that the worst off are best cared for and are treated equally, including the right to start a family. (Nations, 1948) Simultaneously, we want to create a world for each other in which every individual can experience the full diversity of the wonder of life. However, our current conception of equal treatment results in the continuation of an iterative process in which traits that inhibit individuals from 'experiencing the full diversity of the wonder of life' keep being passed on to the following generation. In this section I aim to explore a fitting role for the state regarding the governance of the use of CRISPR/CAS.

Let me take the example of the Rawlsian theory of justice and the eugenic policy of the Spartans to illustrate how different political systems may address the genetic plurality of its population. The Rawlsian theory of justice could be used to describe dynamics of western society, but takes the selfishness of individuals as point of departure and not the strength of the society. In his theory, John Rawls argues that any set of humans in their 'Original position', under the veil of ignorance, will agree on a social contract that will provide the best benefits for who is worst off. (Rawls, 1971) However, it seems that Rawls presupposes these humans to be egoistic because they all want the best situation for themselves in case they end up the worst off. An alternative social contract could be provided by a set of people that have the best outcome for the group in mind, instead of individual lives. Such a social system is exemplified by the Spartan system, in which individuals that were deemed unfit for society would die by means of infanticide. In Spartan culture, a 'post-natal abortion' technique was used where children were judged on their worth to live by the elders after they were born. (Cartledge, 2001).

Given the lack of technological advancements, can we blame Spartan society? Can we say that the development of reproductive technology has transformed an immoral action (infanticide) into a morally acceptable one (abortion)? Or, since the Spartan and contemporary practices share the same goal, should we condemn both? Perhaps it is the other way around; now that we act in our best capabilities to provide healthy offspring, can the Spartan infanticide be excused for doing the same with less advanced technologies? If not, does that mean that technologies can make certain actions and practices moral? Can we only morally perform certain actions when we have achieved higher levels of technological advancements? What does that say about humans, morality and technology?

Now, new tools of genetic screening can be used for a more accurate and earlier analysis of 'offspring quality'. By intervening in the grey area between being nothing and a human being in the prenatal timeframe, we have arrived at a combination of Spartan eugenics and Rawlsian justice. Until the legal limit for abortion, the seemingly unfit are (sometimes) removed from society and after a foetus has managed to make it past the legal abortion limit it enters into a system of Rawlsian

justice – at least something close to that in western society. Here, at least, some choices about individual genetic dispositions for the ability to live a meaningful life are made, but because of the liberal nature of abortions, these choices are made for the sake of the child or its parents, and not for its effect on society.

CRISPR/CAS9 technology manages to place itself right in between the life of the individual human and the benefits of society by enabling the possibility to make specific choices about genetic composition. Where can we find the balance of value of human life between (1) physical, individual, aspects that allow a competitive participation within society and (2) social aspects that build on love and freedom and caring for one another? The first favours individualistic, competitive thinking while the second favours social, collaborative thinking. It seems ignorant to design humans that contribute less to society, but to genetically implement the opposite seems at least as much of an atrocity. So should we not care what impact liberal eugenics would be creating for society? This, too, is not what we want. Is the only available option to denounce CRISPR/CAS technology? Or can we find a way to develop (with) this technology and its 'products' in order to bring about both healthy individuals and a strong society?

Normativity as an Evolutionary Concept

There are two ways in which I will consider normativity as an evolutionary concept. First, in the sense that the idea of normativity, of moral behavior, is a result of human evolution and human intelligence. Second, the idea that normativity is not static, but that our conception of moral conduct evolves and changes with time.

The evolution into moral beings

At some point in history, the human evolved from a social animal into a moral being. The rough difference between social and moral is that the social drive is not experienced as rational thoughts, but simply by drives, while moral behavior is a result of rational thought. Since this has been a step in evolution, one that appears to have provided to be beneficial for human survival, it seems somewhat out of place for 'morality' to make claims against other steps in evolution.

The moral mediation of CRISPR/CAS

There are several ways to understand the moral dimension of technologies. The first way understands CRISPR/CAS in itself as good or bad. Is the development of such a technology morally loaded and if so, are we doing right or wrong to do so? The second way understands the technology in itself as neutral, but is considering the morality of how it can be used. What do we define as good

and bad uses of this technology and does it invite to a certain behavior? A third way of understanding the morality of CRISPR/CAS is the idea that this technology is mediating our morality. This means that what we consider moral or normative behavior depends on the technical context in which we find ourselves. In 'Moralizing Technology' Verbeek has shown that ultrasound technology does more than create an image of a fetus, it also takes part in shaping the relation between father and child. (Verbeek P. P., 2011) In a similar way, CRISPR/CAS technology will do more than alter the genetic constitution of an unborn child, it could also transform the relation parents have with their children and the way in which these children relate to themselves, and others. Is this something we would want to be meddling with? Is there a way to make sure we are mediated in a 'good' way? Certainly if our conception of what is 'good mediation' is subject to that very moral mediation, ethics seems to lose its ground.

Is a moral evaluation of evolution technologies even possible?

Evolution and technological mediation makes it difficult to take a position from which to evaluate CRISPR/CAS technology. Is CRISPR/CAS a technology that is happening to us, in evolutionary terms, or are we doing this to ourselves, in eugenic terms? In the first option we are being selected by environmental pressures, while it is neglected that we are the ones creating this technological environment. In the second, we seem to assume we are in control of the effects of technology, not acknowledging that 'technologies do things too'.

If we accept the view that technology mediates morality, then gradual technological development may eventually lead to the acceptance of CRISPR/CAS. How can we possible conclude how humans ought to interact with technologies that shape themselves from an ethical perspective alone, when these technologies do not only form their physical constitution but mediate their morality as well? It seems that there is no 'outside' perspective possible from which we can judge technologies.

Since it seems impossible to postulate an unmediated ethical theory of what is good, I propose we need an anthropological approach. If we want to say what is good for the human being, not only as individual but also as a species, we first need to know what this human being is. Perhaps there is a possibility that, from the right anthropology, a normative evaluation for CRISPR/CAS could be executed.

Evolution, Ethics, and Anthropology questioned by Crispr/Cas.

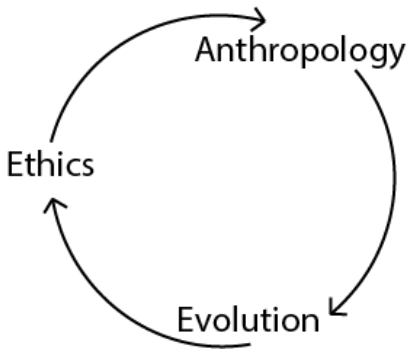
Although we have gained a lot of insight about our biological functioning, we still abide by social reproduction in which the 'genetically less endowed' reproduce as much as their peers. Should we not want to evolve? Are we all so crazed about living our own happy ephemeral lives that we do not care for the consequences of the species on the long term? As we have seen, it is not as simple as that. We have not only evolved as physical beings, but moral beings as well, and even technological beings.

For a long time there was nothing that could be done against the 'degradation of the human species' in terms of physical properties without degrading our humanity in terms of moral self-understanding. Now CRISPR/CAS can potentially break this impasse, but only if the right balance between ethical and evolutionary thought can be found.

The intersection of evolution and normativity brings forth difficult problems, not in the least because of their clash in the former century. The moral, the political, the technological, the anthropological, the social and the biological dimensions of the human all find themselves being questioned.

This means that any pursuit of evolution can only be excused if it is persecuted within the moral boundaries within which we understand ourselves; anthropological boundaries. But exactly those anthropological boundaries ought to be defined by our understanding of evolution, because this evolutionary history makes us who we are.

To understand evolution we require ethics because questions about the right kind of evolution arose. Ethical thinking requires an anthropological perspective because it can only make claims about what a good kind of evolution is, if it knows what the human is. And finally, anthropological thinking requires an understanding of evolution because understanding where we come from is a fundamental part of understanding what the human is. Thus, in the attempt to get a grip on the understanding of ethics, anthropology and evolution, all terms mutually constitute each other, as depicted in the picture below.



Evolution, ethics, and anthropology are interdependent concepts when we look at the possibility of thinking ethically about evolution through CRISPR/CAS, or when we try to understand what the human being is on an anthropological level. How can we then ever understand any of these terms, other than in their relation to one another?

Archimedes once said: "Give me a place to stand and with a lever I will move the whole world". The very problem that CRISPR/CAS raises is the lack of a fulcrum, a point to stand on, because it challenges the understanding of each term. In the next section of this chapter I will argue that the concept of 'technology' may be the fulcrum we need to understand and develop CRISPR/CAS further.

3. Understanding Evolution using CRISPR/CAS9 through Anthropo-Ethics

In the first part of this chapter, where I attempted to understand the role of technology in human evolution, I arrived at the question of anthropology; who is this human? Consequently, this led to the question of ethics; what is right for this human? Is there a right way to evolve and is it even right to want to evolve? However, in the second part of this chapter, where we looked at the ethics of evolution technology, we arrived at anthropology: What is this human we are judging? In the case of CRISPR/CAS, morality and anthropology are both depending on each other in order to provide answers. When the first perspective aims to find certainty in the second perspective while the second perspective requires certainty in the first, both seem to circle around each other without being able to form a solid perspective from which we can look at CRISPR/CAS9 technology.

We have already seen that thinking from the perspective of evolution or ethics provides different views on how to relate to CRISPR/CAS. Should we understand it as evolutionary or eugenically? Anthropologically unavoidable or ethically detestable? In this third part I question the attempt to connect ethical and anthropological thought so that both individual attempts to understand CRISPR/CAS9 may be transcended by their combination, and whether we can move further than the understanding these individual fields bring us. First, I will question if it will be possible to build a solid base from the composition of ethics and anthropology from which to understand CRISPR/CAS; an 'anthropo-ethics' as I will call it. If not, will it be entirely impossible or could both be combined by the concept of technology as a catalyst to combine both views?

The need for an Anthropo-Ethics of Evolution Technics

We have seen that an anthropology as evolving beings and an ethics of human beings is opposing each other in many ways. In this section I wish to explore whether it is possible to find some overlap

in these perspectives that can guide us to evaluate what we should do with evolution technics such as CRISPR/CAS. At the end of the second part of this chapter I concluded that ethics, anthropology, and evolution seem to form an interdependent loop from which no clear conclusion can be distilled.

The idea of an 'anthropo-ethics' is not to let these terms oppose each other, but instead to find strength in their overlap. So where can we find this overlap? It was the introduction of a new technology which complicated the relation between anthropology, evolution and ethics in the first place. Therefore I suspect that a better understanding of the relation between technology and ethics, and technology and anthropology, will lead to a better understanding of CRISPR/CAS.

Technology as a catalyst to combine ethics and anthropology

From ethical perspectives, technologies have been considered as subjected to ethical evaluation while the idea that our conception of ethics is subject to technological mediation is often forgotten. Since technologies are such a fundamental and overall present factor in our lives, they take part in shaping what we consider to be acceptable. The development of new technologies is opening new ways to understand the world, and consequently what is appropriate behavior in that world. (Verbeek, 2007) From this perspective, ethical thought is as much subject to technologies as technologies are subject to ethical approval.

From an anthropological perspective, there are different ways to view the human in relation to technology. In the simplest of versions, either the human or technology is just a tool in the hands of the other. This implies only one of the two is a cause, while the other is powerless and exists only to obey to the logic of the other. The evolution of the human can – in those eyes – be understood as a biological, Darwinian evolution in which technology at best counts as passive 'environment'. From the other extreme the evolution of the human can be seen as a secondary effect of the evolution of technology. Technological determinists would state there is a technical tendency that cannot be stopped by any power residing in the human, making the human nothing but a puppet that dances on the tune of technology. Less extreme views hold a subtler relation between the human and technology, such as the philosophical anthropology of Bernard Stiegler, in which "neither of the terms holds the secret to the other" (Stiegler, Technics and Time 1: The fault of epimetheus, 1998). This mutual relation in which both terms are co-shaped by each other is also known as a *transductive* relation. In this view, the human and technology evolve together, pushing each other forward. Although, 'forward' implies an absolute direction so perhaps it would be more fitting to say they push each other around.

After this short exploration of the potential of the role of technology in better understanding CRISPR/CAS in terms of ethics and anthropology, I am confident that it will be helpful. Both concepts

of ethics and anthropology have shown to be able to be understood as fundamentally intertwined with technology.

Chapter Conclusion

The goal of this introductory chapter was to sketch the unique possibilities that CRISPR/CAS offers for the influencing of our own evolution and to unravel the maelstrom in which evolution, ethics, anthropology, and technology find themselves and constitute each other. This all was required to formulate and defend the further structure of this thesis.

In the first part looked at the role of technologies in human evolution. We have seen that our reproductive actions are often mediated by technology, which shows that humans and technologies are very close to each other. So close even, that we should reconsider the role of technology in our anthropology. Secondly, this mediation of our reproductive practices raises the question of its desirability, and the desirability to control that aspect of technological mediation.

In the second part I looked at the ethical questions that are raised by CRISPR/CAS9 technology. I concluded that the ideals of evolution and normativity are entangled in a difficult position, but the availability of new technologies seems to have wriggled an opening into this position, teasing with the possibility of pursuing evolution within ethical boundaries. However, we require an anthropological understanding of the human in relation to our evolution if we are to understand what moral effects CRISPR/CAS has on the human.

In the third section, I reflected on the first two parts, showing that anthropology and ethics seemed to approach CRISPR/CAS9 technology from completely different angles while they still required each other's fundamentals to form a solid base from which to analyze CRISPR/CAS. However, when both terms presuppose the other, a solid foundation from which to analyze CRISPR/CAS is lacking. To counter this problem, I proposed to use the concept of an 'anthropo-ethics' which aims to combine both terms in the understanding that we need exactly the combination of anthropology and ethics to understand the intricacies of CRISPR/CAS. Furthermore, I proposed to use the concept of our technicity to form the basis on which we can attempt to combine the concepts of anthropology and ethics to be able to find a balanced perspective from which to regard CRISPR/CAS9 technology.

In conclusion, in order to be able to postulate certain conditions within which we can actively influence the course of human evolution by means of CRISPR/CAS, we must understand the role of our self-understanding in our normative evaluation, how human anthropology gives rise to ethics, and the mediating role that technology plays in our understanding of anthropology, ethics, and evolution. This leads to the following structure of the next chapters.

In the second chapter, I will take a close look at ethics and technology by analyzing the bioethical discussion on genetic engineering and setting it off against postphenomenological critique in order to account for its lack of understanding human-technology relations and criticizing it for its lack of anthropology. In the third chapter, I will look at anthropology and technology by looking at the philosophical anthropology of Stiegler, which I will connect to his normative and political thinking about technics, to start an 'anthropo-ethical' analysis of CRISPR/CAS. In the fourth and final chapter, I will reflect on this 'anthropo-ethical' analysis, propose some improvements by confronting Stiegler with postphenomenological critique and vice versa. Finally, I will conclude with the conditions within which we can influence human evolution from this anthropo-ethical perspective.

Chapter 2: Ethics of CRISPR/CAS and the role of anthropology

"I've come up with a set of rules that describe our reactions to technologies:

1. *Anything that is in the world when you're born is normal and ordinary and is just a natural part of the way the world works.*
2. *Anything that's invented between when you're fifteen and thirty-five is new and exciting and revolutionary and you can probably get a career in it.*
3. *Anything invented after you're thirty-five is against the natural order of things."*[2]

— **Douglas Adams**, **The Salmon of Doubt**

In the last chapter we have seen that CRISPR/CAS is questioning the boundary between humans and technology. These new biotechnologies can be used to alter our very own building blocks, such that our 'biological selves' have been technologically produced. The boundary between human and technology – between the natural and the unnatural – is becoming a grey area when that what we make is that which we are. What is the difference between genetic modification and vaccination and education, is it our responsibility to take care of each other? But on the other hand, what is the difference between genetic modification and doping? And could we become addictive to such self-improvement, perhaps to the extent that we lose our freedom? Would genetic modification lead form of modern slavery a la 'Brave new world' – and would we be slaves of humans or technologies? – or does it offer a valuable way to transcend ourselves? In this chapter I will focus on understanding how this dynamic can be understood from an ethical perspective.

The ultimate goal of this thesis is to understand what we should do with CRISPR/CAS and why. Should we welcome this technology – and within what conditions – or do we reject it? But I do not expect to be able find such an easy answer. The goal of this chapter is to find out how we should understand the 'ethics of technology' in order analyze an evolutionary technology such as CRISPR/CAS.

In the first part of this chapter I will look at the arguments in the bioethical debate surrounding 'liberal eugenics' in order to find out what anthropological presumptions are made that cause the current discussion to have come to a stand-still. I will criticize both sides of this ethical debate on account of failing to even try to find a common ground, resulting in a superficial discussion that does not reach the depth that is necessary to come to moral conclusions of genetic enhancement technics.

[2] Perhaps it is no coincidence the average age of the bioconservatives featuring in this thesis tops that of the transhumanists by ~15 years

In the second part of this chapter I will build on postphenomenological critique of the same bioethical discussion to emphasize the importance of the understanding of human-technology relations. In the third part I will combine these critiques to propose to work from a philosophical anthropology as a response to both criticisms in the next chapter.

1. Anthropology in the bioethical discussion on liberal eugenics

The bio-ethical discussion on the use of evolutionary technologies such as CRISPR/CAS9 encompasses a wide variety of positions and arguments on how we should relate to evolutionary technologies and why that is so. In this first part of the second chapter I will explore the different ethical perspectives on evolutionary technologies, or liberal eugenics. I limit myself to five arguments; three bioconservative and two transhumanist: Intergenerational Ethics, Liberal rights, the moral case for benevolence, protecting human nature, and protecting non-biological values.

Intergenerational Ethics

The bioethical discussion encompasses a discussion on intergenerational ethics, with a generation that cannot speak for themselves. There are conflicts about the agency of that entity and the extent of the liberty of its parents to decide what is right for this person-in-becoming.

On the bioconservative side**,** Leon Kass, in his essay 'ageless bodies, happy soul', argues that the problem with enhancement is with increasing parental control "the charge of genetic despotism of one generation over the other." (Kass L. R., 2003) Jurgen Habermas has three arguments that are particularly relevant for the discussion. The first states: "the other side of the power of today is the future bondage of the living to the dead". (Habermas, 2003, p. 48) This refers to the despotism of the current generation over the following if we decide their physical constitution. Second, the use of genetic enhancement leaves no communicative process with the affected, barring the individual-to-be from being the 'undivided author of his own life'. Once the enhanced has been born, it cannot reflect in a 'revisionary' process, deny or unmake the DNA that makes him *him*, opposed to his mental constitution that is open to retrospective therapy. Thirdly, Habermas argues against any form of eugenics because "subjection of a person to the unjustly imposed arbitrary will of another person is ruled out in the moral universe." Sandel states that liberalism has gone too far when parents claim the sole right to shape their children and denying the nature its chance to do its work of unbidden shaping. (Sandel, 2007).

Liberal rights

In the middle between transhumanism and bioconservatism, Agar argues that in the same way a single mother is allowed to choose a sperm donor, she must be allowed to choose this artificially created sperm donor. (Agar, 2004) Similarly, John Harris builds on the position that reproduction is an individual choice, and thus we should avoid any 'tyranny of the majority", as J.S. Mill described it: "If there is no good reason to justify coercion, freedom of reproduction must grow along with technological possibilities to prevent corrosion of rights". (Harris, 2007). Secondly, Harris claims an embryo does not have any rights because it is not a person, and as with any post-natal child, the parents are responsible for making decisions the child cannot make himself. Harris states "If the end [altering human DNA] is legit, then the means are of no ethical concern. We should only choose the best and most reliable, efficient and economical, methods reaching that goal." (Harris, 2007)

The moral case for benevolence

There is a fine line between therapy and enhancement, if there even is one**.** Transhumanists argue that disease is only relative to an arbitrary norm, and thus if genetic engineering ought to be permitted for the sake of therapy, it must also be allowed for enhancement. After all, both are relative improvements to one's original state. (Agar, 2004) Furthermore, Agar states that "If we may produce certain traits by nurture, we may do so by modifying their genomes". With a similar logic, Agar argues that if it is acceptable to leave in place a natural genetic arrangement with enhanced ability, then it is morally acceptable to engineer an arrangement with the same effects. (Agar, 2004, p. 89)

Building on Daniels, who states that what we consider to be a disease is only socially constructed, not biologically given, Harris argues that if we want to minimize all forms of harm there may be no distinction between therapy and enhancement. (Harris, 2007, p. 45) That means that not relative, but absolute enhancement is what we should strive for. Now that we have the ability to enhance we also have the responsibility to enhance. (Harris, 2007, p. 118)

Harris does not only defend human enhancement but makes an "ethical case for making better people". (Harris, 2007) Harris denies that there is something special about ourselves as human beings and thinks we'd waste an opportunity for the future if we act as if we had reached the top. If we honour our history of progress, as Harris claims we should, we must make efforts to keep progressing. However, in Nick Bostrom's 'Transhumanist Values', human self-development is equaled to technological development. So for Bostrom, there is no reason to pose limits on our own development. (Bostrom, Transhumanist Values, 2005)

The alienation thesis

This bioconservative argument concerns non-biological human qualities that are in becoming alienated of human values. (Sharon, 2014) Bill McKibben argues that achievements that result from natural arrangements have value that artificial arrangements lack. (McKibben, 2003) Francis Fukuyama holds the idea that enhancement is wrong because "Biotechnology will cause us in some way to lose our humanity – some essential quality that has always underpinned our sense of who we are and where we are going…" (Fukuyama in Agar, 2004) Leon Kass argues against attitude of mastery that results in a dehumanizing, a loss of respect, for our fellow humans. He expects a world where an underlying quality of humanity is lost. (Kass L. R., 1997) Habermas sees in genetic enhancement more than only a technology that is likely to be used for immoral behavior towards other beings. For him, the complete (moral) self-understanding of the species is at stake when we make the step towards creating 'ourselves'. Sandel claims "changing our nature to fit the world, rather than the other way around, is actually the deepest form of disempowerment". (Sandel, 2007, p. 97)

Protecting Human Nature

Bioconservatives assign some fundamental value to human nature, which is something that should not be penetrated by technologies, claiming a fundamental difference between human and technical improvement. Sandel emphasizes the value of life 'as a gift', of which the giver does not need to be a God, but can be natural as well. Building on Locke he states that our 'lives and liberty' are not ours to give away. (Sandel, 2007, p. 94).

Leon Kass has argued that we ought to stay away from genetic engineering because it evokes an intuitive feeling of crossing lines that ought to stay closed, calling it a 'wisdom of repugnance'. (Kass L. R., 1997) . Furthermore, Kass sees being errorous – wandering – as a fundamental quality of being human. The ability to walk into unknown paths with our genetic material is at risk of being lost when we take the power to design our own paths.

The missing anthropology behind bioethics of evolution technologies

This short overview of the bioethical discussion shows the need for an anthropological basis. For their stance on Intergenerational ethics, bioconservative require an understanding of the relation and connection between different generations, and the role of technologies in that relation. Transhumanists require an understanding of the authenticity we should assign to embryo's, who will become responsible adults at some point. Considering the moral case for benevolence, both parties have different expectations of what is 'benevolent'. Transhumanists focus on physical properties for which should give rise to the best human being, while bioconservatives see a danger to the non-

physical side of human experience with the use of CRISPR/CAS. Finally, Bioconservatives claim value on the 'untouched' human being, and our condition of being in this world 'at random'. All these positions take claims on what it means to be human – and should thus be seen as anthropological positions. Anthropological assumptions play a fundamental role in the opposition of bioconservatives and transhumanists. Their incommensurability stems from a common neglect of the fundaments on which they claim to build their arguments. It has been brought to light that both sides' lack of understanding, or at least explication, of the philosophical anthropology can be identified as the fundamental issue that is causing this seemingly incommensurable gap in the ethical discussion.

The value of anthropological arguments has been stressed by Jan-Christoph Heilinger in 'Anthropological Arguments in the Ethical Debate about Human Enhancement' (Heilinger, 2014). Heilinger argues for the importance of an explicit debate about the essential question of which aspect of 'being human' ought to have normative relevance. According to him, this question of what counts as 'human nature' should be answered via a 'quasi-democratic' process. Heilinger does not think we would find an understanding of the human being that will be true for once and for all, but rather that we would be continuously developing a new understanding of what it means to be human: "the debate about the normativity of what it means to be a human being must be an open and opening debate, not a closing one". Although he categorizes the ethical debate around human enhancement into the four areas of justice, risk, autonomy and anthropology, he does state that "[anthropological arguments] are elementary, because elements of this basic debate find their ways also in the other layers of the debate" (Heilinger, 2014, p. 114).

The possibility of an anthropo-ethics of evolution (technologies)

The ethical perspective on evolution resulted in a call for an anthropological foundation. If this anthropological foundation is nothing else than an understanding of how we have evolved, would it not be evolution itself who is at the foundation of determining how we ought to evolve further? If this is the case, then what does the ethical perspective contribute? Is there even still a place for ethics when CRISPR/CAS is concerned? Should we not leave evolution to itself?

When we try to understand the relation between ethics and evolution, we can see ethics as a result of evolution. In that way, ethics is evolutionary; we have evolved into ethical beings, which is part of what we are now. If that prevents us from influencing our evolution any further than so be it. We can also turn this understanding around, and say that evolution has ethical properties. In that case, evolution can be 'good', or 'right'. Within that understanding, we can discern between evolution itself as being good, or as evolution being something that can be done 'good'. Or in other words, evolution is normative of itself or it can have normative properties. As I argued in the first

chapter, we have yet to understand the role of technology in all this. I hope to come closer in the following part of this chapter.

2. Postphenomenological critique on the ethics of technology

The analysis of the former section has shown that the difference between bioconservatives and transhumanists stems from a fundamentally different understanding of the human condition. Although the discussion is portrayed as an *ethical* discussion about CRISPR/CAS, it seems that the fundamental point in which the perspectives differ is one of anthropology. Authors in postphenomenology have also criticized the bioethical discussion surrounding genetic engineering, but on different grounds. (Verbeek P. P., 2011) Their main critique is that both sides do not sufficiently appreciate human-technology relations. In their view, the humanism that is implicit in the bioethical debate prevents them from a constructive solution of the human *with* technology, instead of the human against technology. (Sharon, 2014) In this section, I will first explicate transhumanist and bioconservatist implicit human-technology relations and then see how postphenomenological thought criticizes these positions.

Transhumanists human-technology relations

Transhumanist anthropology is often a lack thereof. I mean this in the sense that they do not hold on to a fixed understanding of what is human. The essence of being human has more to do with 'being' than with 'human'. That what makes our lives special has nothing to do with an 'essence' or a certain direction that evolution took. For them, it is the freedom to develop ourselves – as individuals and as a species – that defines us as human beings. These 'boundaries of nature' do not define us, but limit us to reach our potential. (Bostrom, In Defense of Posthuman Dignity, 2005)

Transhumanists want to overcome that what is called 'human' at the moment, which may include our current values. Biological 'humanness' is a quite arbitrary understanding in their eyes. What is more important is that we are intelligent and experiencing beings. It is our goal to get the most out of life and as beings that are not caged by the limits of humanness, this means we ought to attempt to transcend this limited form in order to breach the current boundaries of our experience of life. The way of doing so, is by technology. In transhumanist thought, technologies can be utilized to bring us to another level of experiencing life. By attaching them to us, or in the case of CRISPR/CAS, by using them to redesign ourselves, we can become intelligent and experiencing beings that breach the limits of human capabilities. (Bostrom, The Future of Humanity, 2009) (Humanity+, 2009)

Bioconservative human-technology relations

Bioconservatives aim – as their name suggests – to conserve something biological. As their arguments have shown, this 'something biological' is understood in opposition to something technological. The biological core that is worthy of protection from the technological threat is in some cases related to a religious conception of the human. From most religious perspectives, the human is already created by another creator and by acting to improve on that creation, we would metaphorically attempt to dethrone the god that created us. There are similar argument adhering to the natural randomness of existence as human essence, in which the hegemony of 'natural' nature could be perceived as something religious, or at least spiritual, something of existential value. For bioconservatives there is no level of 'being' that precedes the human being, nothing that gradually leads up to the human. It is either nothing or everything. To identify as a human is already the highest form of self-identification, and to break the boundaries that have historically been used to define what a human being is, is a cruel betrayal to one's own being in the world. In bioconservative anthropology, there is more focus in understanding of the human being as living an experienced mental life, compared to the more physical orientation of transhumanists.

This shows a clear bifurcation between what is an ideal human for bioconservatives or transhumanists. While bioconservatives claim to be appalled by the perfectionism portrayed by the transhumanists, they themselves show their own conception of a sort of perfection. Only the bioconservatives 'perfection' is static, preserved, and pristine, while transhumanist 'perfection' is dynamic, ever-changing, and creative[3].

A new ethics of technology

In 'De grens van de mens' Peter Paul Verbeek investigates several conceptions of the limits of humans. (Verbeek P. P., 2011) Limits have a double meaning here; Firstly, it is a question of where the human ends and technology begins, if there is such a transition, and secondly the limit of moral boundaries. Verbeek argues that human experiences are (partly) constructed by technologies; they mediate how we experience our existence. For Verbeek, the question is not whether technologies are good or bad, but how we can responsibly give shape to ourselves with the aid of technologies: how can we do ethics *with* technology? This will not happen by claiming that humans are opposing technologies, either by saying we are in control or technologies are in control. Verbeek claims a hybrid of human and technologies is the entity that makes decisions. To describe what defines us as free human beings, Verbeek quotes Foucault, who says that "Freedom is the human ability to relate to that which influences him". (Verbeek P. P., 2011, p. 56) So in order to be free – which is a

[3] Literally creative, in the sense of being created. Always in becoming.

requirement for being responsible for our choices – we must understand how we relate to technology.

Verbeek is unsatisfied with the way bioconservatives and transhumanists view human-technology relations. In their 'modern' thinking, consequentialism and deontology are strongly based on a distinction between subject and object. This Cartesian split between humans and technology – internal and external – is misinterpreting the relation between humans and technology. This subject-object distinction that is represented in ethics of technology leads to ideas of losing some essential freedom by using technologies. (Habermas, 2003) Verbeek claims we have no 'original essence' that can be betrayed, yet the transhuman course of unbridled human 'improvement' is not understanding what the lack of essence means either. For Verbeek, our human condition – the condition of having no condition – gives us the task to responsibly give shape to ourselves. We should not presuppose the answer to the question of improvement is 'technology', but we should ask the question together with technology. To use the vocabulary of Sloterdijk, we should set the rules of the human zoo in discourse with technologies. We should not consider if the technologies are right, but how we can imbed technologies in society the right way.

However, it still remains difficult to find the right balance in the co-development of humans and technology. The danger of accepting the matrimony of humans and technology may be portrayed by drug addiction. At this moment I may be skeptical about the use of heroin to aid in the pursuit of 'the good life' but I can imagine that once I'm on heroin, I would strongly agree that heroin contributes to 'the good life'. So we must keep in mind that our continuous technical embeddedness is always already mediating our perspective and our values. This again emphasizes the point that we can only work *with* technology to give ourselves (both humans and technology) shape because there is not outsider position possible. Instead of an 'anthropo-ethics' that theorizes a separation of the human and technology, we need an anthropo-ethics of their interweaving.

This postphenomenological critique on the bioethical discussion has stressed the need for understanding human-technology relations as a base for ethics of technology. In the next section I will combine the need for an anthropological base with this need for the understanding of human-technology relations.

3. An anthropo-ethics that recognizes human-technology relations

In the former two parts of this chapter, the bioethical discussion between bioconservatives and transhumanists has shown itself to be incomplete. Both sides have – from their point of view – fair arguments but neither side is looking for a common ground or even attempting to shine light on its own anthropological grounds. In the first part of this chapter I argued that we require an

anthropological understanding of the human to be able to judge 'evolution technologies'. In the second part of this chapter, I built on postphenomenological critique of this discussion to argue that it also requires a better understanding of human-technology relations. According to Verbeek we must leave this discussion that is stuck in a subject-object distinction of modernity and get back to the virtue ethics of the Greeks who asked 'what makes a good life?' Asking such questions should transcend the bioconservatives that prematurely distance themselves from technologies and the transhumanists who prematurely accept technologies without reservations.

We require a new perspective that needs to incorporate a clear anthropology of the human being and its relation to a normative evaluation of technology on the one hand, and understand postphenomenological human-technology relations on the other. There are, of course, various alternative anthropological ways to understand the human that also make a claim on normativity.

Anthropologies

I quoted Heilinger earlier to stress the importance of an anthropological base for an ethical view on technologies. He himself has proposed four fundamental components of being human. The first is 'being alive' in the sense that we are living creatures that live, grow, and also have the possibility of death. The second is 'having an embodied and embedded mind', meaning we are in the world as physical beings that are both made possible, and limited by, our physicality. He furthermore asserts that he is not implying any dualist understanding, but one that values the importance of physical existence for mental experience. Heilinger's third component of being human is 'being in need of orientation', which relates to our possibility to make choices and our search for wisdom to make the right choices. Fourth and finally, Heilinger describes human beings as 'anthroponomous', which could be understood as continuously self-defining or self-determining. He thereby aims to explain our possibility to continuously understand ourselves in new ways, leaving an open-ness for our self-understanding. (Heilinger, 2014) It will be difficult to value CRISPR/CAS9 in these terms in a singular way because such a technology can be used for different purposes such as increasing strength, intellect, life-expectancy, or even immortality. Each specific use may be questioned in a different way by the fundamental human components. On top of that, the components are open to multiple interpretations. In one sense, genetic engineering is the pinnacle of the self-determination of a species because it is the species that is determining how it will look like, rather than the randomness of nature. On the other hand, when the individual has been determined by its fellow members of the species, he may experience a loss of self-determination as an individual, because others took it upon them to determine him.

There have been other authors to propose other components or fundaments for the human being. For example, in 'Human beings @ Risk', Mark Coeckelbergh proposes the fundamental component of being human as *vulnerability*. In this book, he "calls for a normative anthropology of vulnerability that does not ask which objective risks are acceptable, how we can become invulnerable, or which technologies threaten human nature, but which vulnerability transformations we want." (Coeckelbergh, 2013). CRISPR/CAS9 could certainly help in the transformation of vulnerabilities. By design, we may become biologically less vulnerable for disease, but more vulnerable in terms of experiencing life, in order to prevent 'phenomenological dullness'.

A conception of philosophical anthropology that focuses on the technological aspect of human evolution can be found in the work of Bernard Stiegler, who understands the human as fundamentally *technical* in his magnum opus 'Technics and Time'. The conception of the human as technical proposes quite an interesting dilemma. In this chapter, we started with the question of ethics of technology, which led us to look for an anthropological basis for ethics. But now this anthropological basis is understood as fundamental technicity. We are back at the question of technology, where we started! How can it be possible that technicity precedes ethics of technology? If technics is the anthropological foundation for an ethics of technology, are we running in circles? And if both the starting point and the end-point of our enquiry is technology, where is the human voice in this process? Are we actorless beings in an unstoppable technological tendency? How could such a philosophical anthropology possibly give answer to the question of ethics of CRISPR/CAS9? But on the other hand, how could we better understand the dynamics of technology than from the perspective of technicity?

The philosophical anthropology of Stiegler has a lot to offer in terms understanding and shaping a healthy human-technology relation. Because I have already stumbled upon the issue of human nature being questioned by the advance of technological progress in the first chapter, I will focus in this chapter on the philosophical anthropology of Stiegler. But do bear in mind that other conceptions of philosophical anthropology exist and could provide completely different conclusions on how we ought to deal with technologies. I am merely limiting myself to a specific area of philosophical anthropology, I do not intend to portray Stiegler's work as the singular truth.

The philosophical anthropology of Bernard Stiegler seems to be very promising as a reaction to both these critiques on the bioethical discussion. He builds on the works of the anthropologist Andre Leroi-Gourhan to postulate an understanding of the human as fundamentally technical. This way, both human anthropology and a fundamental connection to technology are addressed.

Another reason why Stiegler seems the right fit for tackling this problem is his normative story. He does not only *describe* the human through an anthropology of technology, he also uses this

originary situation to *prescribe* what (inter)actions are good. It is this combination of philosophical anthropology of technology with his normative thinking on technology that makes his work so valuable to further this thesis.

Chapter conclusion

In this chapter I have provided a short overview of the discussion between transhumanists and bioconservatives. A variety of arguments ranging from appreciation of the 'wonders of nature' to the ideal to live in negative liberty have shown themselves. In order to find out why this normative discussion would not progress, I looked at several questions that unearthed the presuppositions behind most normative arguments. These presuppositions pointed at the direction of philosophical anthropology. To bring this discussion forward, we require a philosophical anthropological understanding of the human being. From such a perspective, one should be able to build a strong, discussable, case regarding the ethics of CRISPR/CAS9 Furthermore, the analysis of the ethical discussion has shown that we require a thorough understanding of how humans relate to technologies in these anthropologies.

In the second part of this chapter I looked at the anthropology and human-technology relations in bioconservative and transhumanist perspectives. I turned to the work of Verbeek in order to attain more insight in human-technology relations and its combination with ethics. According to Verbeek, we must leave this discussion that is stuck in a subject-object distinction of modernity and understand the mediative character of technologies. We should take a new view on ethics, not as a judge but as a supervisor of technology, so that it may grow within humanity as we direct it.

However, this brought up the question of what is then left of ethics. If we accept that a hybrid of humans and technologies are making choices, as Verbeek suggests, we must question if it is still even possible to execute an ethics of evolution technologies. If we are to accept our 'technological nature' as it is, will it still be possible to steer technologies in the direction we want, or would we be left in some 'technological anarchism'?

The goal of this chapter was to find out what we would require in order to connect an evolutionary technology such as CRISPR/CAS to a moral perspective. We can conclude now that we need an anthropological basis for ethical arguments that wish to make claims about our evolution. More specifically, since we want to say something about an evolutionary technology, we require an anthropological base that takes the concept of technology very seriously into account. In the next chapter I will take a look at a philosophical anthropological perspective of Stiegler that understands technicity as a fundamental concept in our evolution.

Chapter 3: A philosophical anthropological base for understanding evolution technologies

> *"I wanted movement and not a calm course of existence. I wanted excitement and the chance to sacrifice myself for my love. I felt it in myself a superabundance of energy which found no outlet in our quiet life."* — Leo Tolstoy, Family Happiness

In the former chapter I looked at evolution technology from the perspective of ethics of technology, which focused on an attempt to evaluate CRISPR/CAS9 technology. I argued that an ethical perspective requires an anthropological basis to build on and a decent understanding of human technology relations. To answer to those demands, I will build on the philosophical anthropology of Bernard Stiegler to understand CRISPR/CAS in the light of a new anthropology.

I intend to find out how an anthropological perspective, one that takes into account the role of technology in the evolution of the human, is connected to normative stance in relation to technologies by Stiegler. Will ethics turn out to be completely unnecessary in the evaluation of CRISPR/CAS as evolution technology, or will an anthropological perspective lead to an ethics of technology? Or is there a middle way possible?

In the first part of this chapter I will conduct an 'anthropo-ethical' analysis of CRISPR/CAS based on the philosophy of Stiegler. Through several central concepts of his work I will connect Stieglerian anthropology and ethics with evolution and technology – represented by CRISPR/CAS. In the second part of this chapter I will compare this Stieglerian perspective to the bioethical discussion to see whether he really was able to react to the critique of the bioethical discussion that I showed in the former chapter.

1. A Stieglerian understanding of CRISPR/CAS

Stiegler's conception of the human anthropogenesis is explained in the first book in his Technics and Time series 'The fault of Epimetheus'. In the first of two parts, he builds on the work of Gille and Andre Leroi-Gourhan and uses the myth of the brothers Prometheus and Epimetheus to explain the human condition as technical. The anthropology of Leroi-Gourhan is unique because he apprehends anthropology as technology. In the second part he develops his theory further in discussion with Derrida, Rousseau, Nietzsche, and most of all Heidegger. There he focusses on the condition of being in time and the experience of being in time, and how this is related to our technical condition.

In the second book of this series, titled 'Disorientation', he turns political and focuses on the contemporary disorientation that is caused by our 'being in technics', which he uses to call for a

European politics of mnemotechnics. In this first part of this chapter I will attempt to understand CRISPR/CAS through a Stieglerian philosophy. I will go through 4 central concepts in his work to understand CRISPR/CAS from different angles, listing Anthropogenesis, Technology as Pharmakon, Temporality and Temporal modes, and Politics of the mnemotechnic system.

Anthropogenesis

Stiegler strongly builds on the anthropology of Leroi-Gourhan, which is unique because he apprehends anthropology as technology, which is the only way to be able to "postulate a nature of the human". (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 93). I focus on three aspects of Stiegler's understanding of the origin of the human. First is the human origin as life becoming technical, forming a transductive relation between humans and technics. Second is the concept that this is something accidental. Third that this is a position in which we are always lacking – without extra qualities other than technics which is only external to us, a prosthesis.

Originary Technicity

The transformation of the animal into the human is described by Stiegler as "the pursuit of the evolution of the living by other means than life." (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 135). It all happened when the first animal took up the first stone, and used it as a tool. From then on, the Stone Age human gradually evolved into the neanderthaler, during which the human cortex and his stonecutting technique grow at an equally slow pace. In that movement, humans and technics emerged, a '*coup*' as Stiegler calls it:

> "Everything is there in a single stroke; everything is differentiated in one coup, together. The essential element is the inorganic organization of memory. It should not be understood as a cause but as a *coup*, whose development is marked simultaneously on tools, on the cortex, on the group, and on the territories that it impregnates, occupies, or cuts across." (Stiegler, Technics and Time 1: The fault of epimetheus, 1998)

It is thus impossible to think of the human as a purely biological being that has merely chosen to taken up technology in its path of evolution. For Stiegler, technics *is* the path of evolution on which the human came into existence; technics is the fundament of our intelligence and our temporality, not a result of it.

Transhumanists couldn't have thought of a better anthropology than this 'originary technicity', one might think. If we have evolved into the human being via technics, than sure it must be permitted to evolve further through the use of technics.

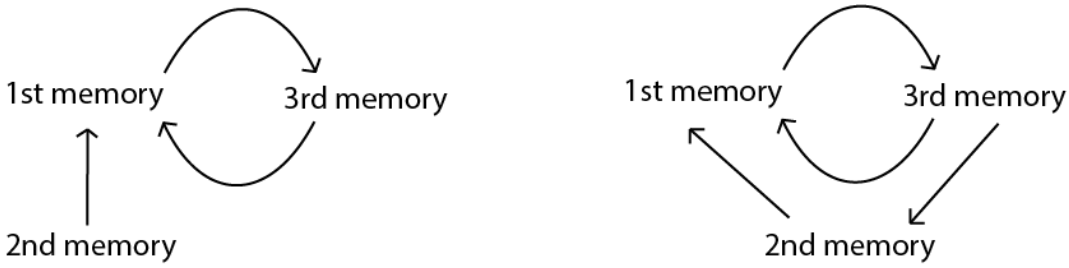
The accidental fall into memory

For Stiegler It is most important that our prosthetic condition is accidental. It had to be an accident because before technics, there was nothing with the mind to willfully use the stone tool. For Stiegler, who tries not to think in terms of opposition, the fall *is* the Origin. There never was a 'pure' human before the fall, only ever the fall. In this accident, we acquire a third memory.

The first is the memory of our minds, which is only internal. The second is genetic memory, of which we have nothing to say – until recently – but is passed on to the next generation. The third memory is outside of us, ek-sisting, and is described by Stiegler as *epiphilogenetic memory.* This third memory enables the sharing of knowledge and human understanding through *Mnemotechnics,* in which Mneme is Greek for 'memory'. This describes the memory function of technologies, and the human ability that developed together with technics to use technologies as external memory. At first through stone tools and cultural objects, now through smartphones and every other technological object. We are our own prosthesis in the sense that we shape ourselves through shaping the technics that shape us.

Mnemotechnics should not be understood as specific technologies that aid in our memory, such as writing tools or a USB stick, all technologies are mnemotechnics. Our complete technical environment is continuously and accumulatively shaping the human-world relation by its continuous interaction with humans. The mnemotechnic system informs the way in which we take the world in which we are thrown for granted, to such an extent that "technics has become the unthought of philosophy" (Stiegler, Technics and Time 1: The fault of epimetheus, 1998).

Interesting about CRISPR/CAS is that it is a tertiary memory that can directly alter our secondary memory, which no other technology could do before. Our primary memory, the mind, was always already co-constituted by our third memory, but now the second memory as well. And thus our first memory is doubly shaped by the mnemotechnics of our epiphylogentic memory, and indirectly by the genetic memory that is shaped by CRISPR/CAS. While the fall into technics is described as 'accidental', the use of CRISPR/CAS would not be so accidental. Bioconservatives could see this fundamental 'accidentality' as part of our human nature, which we should not betray. However, exactly because it was an accident, it is hardly arguable that it is a good thing, it just happened. We have come into existence as a result of this accident so it seems we ought to be happy about this accident, but do we have to honor the fact *that* it was an accident? Is there something intrinsically good about our accidental 'nature'?



The relation between our memories before (on the left) and after (on the right) CRISPR/CAS

This new configuration of memories in which the third memory (technics) can influence the second memory (genetics) can be understood as the enabling of a new form of Lamarckian evolution. Now the events that happen in the life of the individual can influence the genetic constitution of its offspring because they will determine what this individual finds valuable in life, which influences his choice on what genes to pass on – even if he does not biologically owns those genes, but only technologically 'possesses' those genes.

Always Lacking

Third and finally, the condition of *lacking* or *default* comes forward as fundamental. Our origin is not only fundamentally accidental, but also incomplete.. 'le defaut qu-il faut' – or 'a necessary fault'. We are Gehlenian 'mangelwesen'. Stiegler describes via the myth of the brothers Prometheus and Epimetheus that the position of lacking is the 'accident' of Epimetheus, who forgets to distribute any qualities to the human, which leads to a falling into technics to compensate our lacking. "Humans are essentially forgotten, and there is nothing else to their origin than this fall, the default. All in one step." (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 190)

In this myth, technics – represented by the promethean fire – brings forth the experience of *Eris*, which should be understood as the drive for competition and envy, there is a 'quarrelsomeness' that has originated simultaneously with technics. When Zeus sees the war and chaos that follow from Eris he sends Hermes to equally distribute *Dike* (justice) and *Aidos* (A sense of the right proportions). It is important to note that Aidos is not the knowing of boundaries, because the human cannot have boundaries when it has no essence. Aidos is only a *feeling* for boundaries, an anticipation of the good or bad effects of actions. (Lemmens, Gedreven door Techniek, 2008)

What does this mean for CRISPR/CAS, which does not only work as prosthesis to compensate our lacking, but can penetrate the biological domain that gives rise to our lacking? Will this be the moment we turned from *accidental* and *default* to a self-designed being that has overcome its own *lacking*? If this lacking is indeed purely understood as biological, and we would overcome this

lacking, would that make us complete or would it destroy what we are? And would that be a bad thing? Or is our lacking more fundamental than the lack of physical qualities and will we remain to be unfinished, despite all our bio-technical efforts?

What if we should understand our lacking as a mental state? Then it would likely matter less what we do to our bodies, because it only indirectly influences our mental position as lacking. Would it even be possible to address this lacking? Is it a mental state which we can escape when we simply don't see ourselves as lacking anymore or do we find ourselves more fundamentally in a state of lacking, from which we cannot escape through any effort of our will?

Furthermore, if this lacking – mental or physical or both – is a very fundamental part of our anthropology, is it then *good* to be lacking? Does our 'natural' state of lacking have normative value? And if so, is this lacking worthy of protection? I will discuss such issues in the other fundamental terms of Stiegler.

Technology as a Pharmakon

Although humans and technology are two sides of the same coin, and co-constitutive in a *transductive* relation – in which 'neither of the terms holds the secret to the other' – they are not one and the same. Humans are still in relation with technologies. Stiegler understands technics as a pharmakon: simultaneously a medicine and a poison.

> "The pharmakon is at once what enables care to be taken and that of which care must be taken – in the sense that it is necessary to pay attention: its power is curative to the immeasurable extent that is also destructive." (Stiegler, What makes life worth living: on pharmacology, 2013, p. 4)

In the myth of Prometheus, the fire on the one hand brings warmth and safety, while on the other hand eris; strife. The idea that technologies bring safety does not mean we must use all technologies unconditionally nor does it imply we should reject technologies because they bring strife. It is our condition to find ourselves in this struggle with this pharmakon. Technologies are simultaneously curative and destructive. Like the wings of Icarus, we must always try to find a balance between the two. After all, Stiegler's philosophical anthropology describes that there is no human outside of technics. But there is a difficulty in trying to find this right balance because our perception is always already influenced by technics: "The pharmacological problem is that we may lose our ability to understand and question the situation of our being. The situation is pharmacological in that: (1) the prosthetics of questioning is poisonous; it bars access to the question. But also (2) this prosthetics is

the only remedy for this poisonousness itself." (Stiegler, What makes life worth living: on pharmacology, 2013)

CRISPR/CAS as a pharmakon has the hope of building better bodies, but the danger of being destroying a part of our spirit – alienating us from ourselves. When we learn that we can technically fix the problems that are a result of our limited bodies, we are at risk of seizing to accept ourselves and each other as we are. Bioconservative thinkers such as Sandel have emphasized this danger of genetic engineering. When we start to see natural deviations as 'design flaws', we are in danger of seeing the world as a rationalized, quantified place in which we can never be satisfied. In the case of CRISPR/CAS9, this dissatisfaction targets even our bodies, the DNA we are made of. It simultaneously helps us to understand ourselves in terms of our DNA, and applies a normative value to this understanding. Because such modes of thinking would be damaging to human thought, CRISPR/CAS quite literally becomes 'curative to the immeasurable extent that is also destructive'.

> "… Genetic manipulations undoubtedly constitute the most striking technological development, giving rise to the most disarming discourses: worse than the possibility of sheer destruction of humanity, they make imaginable and possible the fabrication of a "new humanity", or of a pseudo-humanity, and without even having to dive into science-fiction nightmares, one can see that even their simple current application destroy the oldest ideas that humanity has of itself – and this, at the very moment when psychoanalysis and anthropology are exhuming the constitutive dimension of these ideas, as much for the psyche as for the social body, beginning with ideas concerning kinship relations." (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 87)

The destructive and curative potential cannot only be found in the physical functions of technics, such as fire that warms and burns, but also in its mnemotechnical functions. Because these technologies form our epiphylogenetic memory, which we internalize as our own memory, technics have an immense destructive potential for the destruction of our minds.

If in one and the same movement the human becomes more intelligent but simultaneously loses his capability to use this intelligence to think critically about technics, has the human really improved? Is it really a feat of intelligence to produce it (intelligence) technologically? The question is that of a design that enables to hold on to both evolution and individuation. According to Stiegler, this calls for a 'politics of the mnemotechnical system' of which I will discuss the details below.

Temporality and Temporal mode

Technology is fundamentally constitutive for our experience in time in two ways. First, the very fact that we are time-experiencing beings is a result of our being in technics. Stiegler states that 'as soon as memory is artificial (artefactual), there is time, constituted as already-there.' Secondly, we are in time in a specific way – a temporal mode. This temporal mode is also inscribed by the mnemotechnic system, as our epiphylogenetic memory. The danger that CRISPR/CAS poses is directed at both temporality and the temporal mode.

Temporality

Stiegler builds on Husserl's phenomenology of temporality to explain the fundamental importance of technology for the human experience of time. In the example of listening to a melody, Stiegler describes a primary and secondary retention, in which the first is only an awareness of the current sound being produced, and the second a larger memory of past sounds in relation to each other, which enables the recognition (re-cognition) of a melody, and serves for a protention for the expected notes to come.

However, this is not enough for Stiegler to describe what is going on in listening to a melody. Therefore, he proposes a tertiary retention, which is a retention of memory in technics. Opposed to the primary and secondary retentions, which are held by the mind, tertiary retention is held by technologies. A music box or the sheet music that the musician uses hold the melody, and must be incorporated in the description of the experience of time. It is the availability of technologies that enable the creation of memories because they are the unchanged external objects which can be interiorized. Where human retention is fleeting, tertiary retention, our epiphilogenetic memory has a better recollection.

Going back to the first moment the human started to experience time, it is the very availability of this external memory that has made it possible to internalize any memory at all; to retain anything. In this sense, the accidental fall in technics stands at the birth of retention, and in extension, protention. For Stiegler, temporality – being situated in time – is a technical being in time. Our memory is always a memory that is internalized from technics, and thus the way we anticipate the future is mediated by technics as well.

Stiegler quotes Heidegger to explain how our being in time is historically shaped: "the temporal mode of being of Dasein is historiality. Its own past (general past, not of the individual) goes ahead of Dasein, it does not follow along after it." (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 206) It is because we are as we are now as a 'product' of our combined past in which we are 'geworfen', we are to the future, and anticipate the future, in terms of our historiality. This is why our 'past goes ahead of ourselves', because it mediates the way we anticipate the future and see the

now. For Heidegger, being thrown (geworfen sein) is not to have an origin in itself, but in its past. For Stiegler, this historial condition is only possible through technics, our third memory. Therefore, our sense of self (ipseity) cannot originate or emerge from an internal human condition, but emerges from a relation with technics. Stiegler says "time itself both deploys prostheticity in its concrete effectivity and deploys itself within it" to indicate that prostheticity, precedes and is the necessary condition for, being in time. (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 220)

But if CRISPR/CAS could annul the need for prostheticy, does that lead to the eventual loss of being in time? In Stiegler's anthropology, we have become temporal beings as a consequence of being in technics, which were needed to compensate our lacking. If CRISPR/CAS is in some way able to provide us with the qualities that we have always been lacking, our historical cause for temporality may be removed. The danger a collective suicide of awareness, a 'descent of the human' into a lower life form, is eminent. Will we still remain to be in time when our condition as lacking is overcome and will we then go back to act on our basic animalistic instincts? In other words: is our condition as lacking of fundamental importance for our temporality?

Temporal mode

Next to the danger to temporality itself lays the danger that CRISPR/CAS raises to our temporal mode – the way in which we are in time. We have already seen that Stiegler sees a danger in the pharmacological potential of CRISPR/CAS. Here, I will zoom in on that perceived danger for which he connects technicity to a normativity of being in time. In the former section I showed how Stiegler understands our being in technics as a necessary condition for being in time. However, because of this selective technical environment, we are also limited in our being in time. We are 'stuck' in a temporal mode. Because we are always born as 'falling' into a technological history that is ours because we interiorize it, but is a past we have not lived, we understand the world in the terms that we interiorize from the tertiary memories that surround us in our specific situation.

For Stiegler, this situation in which we are thrown is both something of anthropology – it is unavoidable, it is part of what it means to be human – and simultaneously something of normative value – although we can only live through interiorization of tertiary memory, in some forms it is good and in others it is bad. Here, I will first show how Stiegler connects his philosophical anthropology to normativity, and then look at the normative evaluation of CRISPR/CAS.

From descripton to prescription: The bridge from anthropology to normativity

In this part I will explicate the relation between our fundamental technicity and our being in time, to explain how these can be related to a normative perspective towards technologies. The accumulation of technics and culture which is ours but which we have not lived – what Heidegger

calls the world-historical (Weltgeschichte) – is the basis of our temporality and informs our temporal mode through its mnemotechnical function. Stiegler claims alongside Heidegger that our true relation with technology has already been lost since the time of Plato. It was then that language and reason was used by the Sophists as a technique (tekhné) for their own profit, instead of contributing to knowledge and finding truths (alatheia). This divide between knowledge and technology has existed until the industrial revolution, which was revolutionary because – amongst others – for the first time science and technology were combined. Stiegler perceives the industrial revolution as an inevitable consequence of the human condition of falling in technics, yet is appalled by the way the mnemotechnic system is co-evolving with the human into an unstoppable entropic machine.

Stiegler is concerned about the contemporary western temporal mode – our relation with time – which for him has become one of speed. This relation with time is typical for the era of the anthropocene, the geological era in which the human has such a global impact that we create a significant change to the atmosphere that the term 'Holocene' does not suffice anymore.

> "The specificity of modern sciences resides, essentially, in the speed of its evolution. A speed to which cultural, social and biological systems cannot adapt. We have come to lag behind and, opposed to the era researched by Leroi-Gourhan, we are only left with a 'quasi-intentionality'." (Stiegler, Technics and Time 1: The fault of epimetheus, 1998, p. 66)

Because we are lagging behind we only have a 'quasi-intentionality' and because of that 'quasi-intentionality' we come to lag behind. In historical era before the industrial revolution, a new major technology caused society to re-organize itself by adoption of a new technology. Stiegler describes this process as 'Epochal doubling up', which consists of two steps. In the first step, societal systems and paradigms are in upheaval because of the disruption of new technologies. The second part of the process is called a 'doubling up of the doubling up', a '*redoublement de redoublement*' when the human systems adjust to the new technical one. This *adjustion* is specified as an *adoption* of the new technology, in which the human brings himself into the position of deliberately choosing to accept this new disruptive technology within his own terms. However, since the industrial revolution the human processes of adoption are outpaced by the continuous progress of the technical system. Humanity does not have time to adopt, and is left with only adjustment, in which he *adapts* himself to the terms of the technology. (Lemmens, Gedreven door Techniek, 2008, p. 419)

Because the current technical system is outpacing the other systems, they all seem to continuously attempt to adapt to the ever-changing dynamic of the technical system. If this process continues, even humanity may stop to think critically about the effects of being in technics.

Humanity may accept being within the system and adapt itself to the system, instead of maintaining a critical position towards technics. When humanity replaces adoption of technology for adaption to technology, its relation with technics becomes submissive. The loss of a view of equality with technics leads to a form of *nihilism*, in which the human loses his anticipatory capabilities because the technical system anticipates for him. Humanity would decline to what Heidegger calls 'Das Man'; a being which is not in time anymore. The human, having finished his own "perfect" technical environment, can go back to its animalistic desire satisfaction. Stiegler describes these processes that make humans lose their uniqueness as 'de-individualisation' and 'proletarianization'; processes that limit the human tendency to ask questions and to think in terms of infinity. In the posthuman future Stiegler foresees that "the time of reflection, which is also the time of the question, has finally been removed." (Stiegler, 1998)

In order to prevent such loss of humanity, Stiegler opts for his own 'rules for the human zoo', which he calls a 'politics of memory'. These have the aim to preserve valuable aspects of human life, such as the ability to ask questions, the ability to think rationally, the individuality of humans. A Stieglerian conception of the good life is one that is lived with love. An amateur – which should be understood as 'lover of things' – is opposed to the consumer because he loves the things in which he indulges for their own sake, rather than the gratification of his personal desires. The amateur thinks in long circuits, circuits of infinity, opposed to the short circuited satisfaction of desires of the consumer. The art of being an amateur, which Stiegler calls a 'savoir faire' and 'savoir vivre', which roughly translates to 'knowledge of doing' and 'knowledge of living'. Stiegler finds individuation an important aspect of human lives. It is what makes ones lives unique, to live our *own* lives. This human characteristic of individuation is in danger by the process of proletarianization: "We are at a new sort of war. Not on an internal or external enemy, but against a process, or systematicity that endangers our being in time, mostly the horizon of the long term." (Stiegler, What makes life worth living: on pharmacology, 2013)

Although technology can shape us by means of its mnemotechnic capabilities, in the human brain lays the capability to find consistencies and inconsistencies, errors in the external memories that are provided by our technologies because we still have the ability to think rationally, opposed to having rationalized thoughts. Knowledge is, certainly for Stiegler, the holy grail in the endless struggle in which the human and technics are entangled; the "struggle against stupidity" (Stiegler, What makes life worth living: on pharmacology, 2013). This struggle ought not to be fought by only specialized philosophers, but is a struggle in which the whole of humanity must participate. In Stiegler's words: "philosophy is not a calling, or a talent, but simply an act." Everybody with the will can become aware of the disruption we are teaching ourselves with the technologies that act inconsistently.

In summary, Stiegler is not against new technologies as long they are used for collective individuation instead of collective submission to the capitalist production system which is so typical for technologies in the anthropocene. (Lemmens, Gedreven door Techniek, 2008, p. 500) The point for Stiegler is not the development of new technologies; it is the speed at which this process takes places, that prevents us from fully understanding the impact of these technologies, which prevents an epochal doubling up. To enable this process, Stiegler argues for a politics of memory, which should not be considered as some scheme to control our thoughts, but a movement that encourages the thinking of the individual for himself, and to see the disruptive potential of the pharmakon.

Politics of memory: a Stieglerian normative evaluation of CRISPR/CAS

Although I will not go into further detail, Stiegler is especially appalled by the internal logic of contemporary consumer capitalism, which embodies a tendency of the loss of attention and individuation, a tendency that causes the loss of identity. (Stiegler, We moeten de quasi-oorzaak van het niets worden, van het nihil, 2015). By means of biotechnology this tendency is pushed even slightly further: "This hyper-industrialization slowly penetrates the biological domain and starts to gain grip on our biological 'tradition'; our genetic inheritance, our genetic memory." (Lemmens, Gedreven door Techniek, 2008, p. 403) This 'hyperindustrial control system' is synthesising the temporal mode of the human through its function as epiphylogenetic memory, which, according to Stiegler, is happening in such a way that it leads to the destruction of the spirit – a de-spiritualizaton.

How can we see CRISPR/CAS in the light of enabling individuation? In the case of reproduction, we do it – amongst other reasons – because we are lovers of humanity and we wish to prolong its existence and the quality of that existence in the world. Furthermore, we intend to love the specific, individual life that comes into being and wish it to experience a good life. The use of CRISPR/CAS would certainly improve the physical characteristics of the body and the mind but in whose favor? Is it important to become stronger, healthier and smarter for one's own sake, or is it so that we contribute more to the mnemotechnic system? CRISPR/CAS9 will likely be able to provide both possibilities. On the one hand we may alter ourselves, and alter our self-understanding, in order to become more rationalized beings – which is a turn away from rational beings. On the other hand we could, if accompanied with the right self-understanding, become more capable of individuating ourselves and continue to live pharmacologically and keep our enhanced rationale. Here, 'individuation' should be understood as a process in which the 'I' attempts to understand itself as *one*, as an individual in his own adoption of his (historical) context. However, it must be noted that the process of individuation is never complete, because the 'I' is also a process, a tendency to become indivisible. (Stiegler, Bernard Stiegler: Culture and Technology, 2004)

But what does that mean for CRISPR/CAS? The technology itself is pharmacological, the answer to the question of whether we will achieve the good life with CRISPR/CAS, will be up to our own actions and whether they lead to our own individuation. CRISPR/CAS technology opens up the path to both individuation and de-individuation. The question remains the design of a use that focused on thinking in long circuits; circuits of infinity. Does that mean we should not design for the benefit of a single life of an individual, but to design for the long-term evolution of ourselves? Or is it exactly the opposite and must we design for the individual, so that no individual value may be lost. Or are both sufficiently thoughts of the long term, and does it imply that we ought to design for plurality, such that each individual has multiple options to individuate himself?

Since human lives can only be lived pharmacologically, we must attempt to discern the difference between the poison and the cure. Reading all Stiegler's' complaints about the short term, one would expect he would be satisfied with the infinite consequences of genetic engineering technologies. After all, they are no temporary quick-fix of the symptoms; genetic engineering could get to the root of inheritable disease and cure it forever – how about thinking in terms of infinity! But this would be a misunderstanding of what Stiegler is saying when he refers to the short-circuiting of the long term. He is not only talking about the length of time our decisions influence with our intended action, but also what it does to our 'being in time', the way in which we anticipate the future. But still, is working to evolve ourselves not an anticipation of the infinite? The danger is in the intentionality of the action taken; although the act of genetic engineering will have an effect towards infinity, it can still be de-individualizing when CRISPR/CAS is only used to solve short-term problems, without being an amateur of what is created – human life. His primary battle is with the loss of spirituality in the world by taking fast and calculable solutions - rationalized solutions instead of rational. (Stiegler, What makes life worth living: on pharmacology, 2013)

Gene alteration technologies do not only have a poisonous impact on humanity; their pharmacological characteristics may also be a solution for the loss of knowledge. If we become genetically more prone for the accumulation of wisdom and less for the temptations of proletariazation, wouldn't CRISPR/CAS be of great value? But Stiegler thinks that we would already be proletarianizing ourselves spiritually before any physical change would be made:

> "Biotechnological selection can no doubt lead to the problem of eugenics. But well before that, much more insidiously and therefore much more seriously than that, there arises the calling into question of the selectors that we are, and it arises as the question of a new proletarianization." (Stiegler, Reprodcution, selection and adoption in the epoch of the industrial pharmakon: the new critique of life, 2010)

It seems that that what it offers – a technological fix for a problem of the spirit – is very pharmacological. On the one hand CRISPR/CAS offers a very strong sense of de-individuation because it portrays an image of our fellow humans as controllable, productive beings, rather than beings able to discover themselves. On the other hand it simultaneously offers the solution for the problem its' own practice covers; it promises the possibility to produce more intelligent people, better resistant against the temptations of proletarianism that are caused by the very same technology.

The danger of CRISPR/CAS is that this 'evolution' it enables would be a technically induced one, one in which we allow ourselves to be given shape by technics. There is an idea of acceptance of adaption to technics that must be presupposed before we allow ourselves to be adapted by means of technologies such as CRISPR/CAS. If we let technologies into this private domain of reproduction, could we ever claim that we have adopted the technical system? To use CRISPR/CAS seems to require a loss of self-respect, to give up a position in which we still can value our biological selves within our transductive relation with technics. The danger that Stiegler anticipates is that we could perhaps think harder, but only from a perspective that is blurred by technics. If in one and the same movement the human becomes more intelligent but simultaneously loses his capability to use this intelligence to think critically about technics, has he really become better? Is it really a feat of intelligence to produce it (intelligence) technologically?

The concept of *attention* is at stake here. This is the possibility to remain attentive to the effects of technology, to see it for the pharmakon that it is and to remain vigilant of its dangers. But attention is also a 'taking care' and 'being thoughtful': "Attention has a significance at once psychological and social, and the one does not work without the other. This is fundamentally what distinguishes attention from vigilance – something we share with animals. And this is why attention must be formed, which is the role of education." (Stiegler, Relational Ecology and the Digital Pharmakon, 2012)

A development that causes the loss of our critical perspective towards technology – a loss of attention towards technology and ourselves – is for Stiegler the loss of humanity. Being human is understood as being fundamentally technical, but only if the human can acknowledge and relate to that fundamental technicity. The possibility of this relation to our technicity, which is also only made possible by our technicity, is essential to live a human-worthy life.

In summary, the problem with CRISPR/CAS would not only be the fact that others are selected, or that other (human) beings are being created technologically, but in the way we set up the mnemotechnical system that 'teaches us' a non-attentive attitude towards technics. It is in this

sense we must understand that "posthumanism is a smokescreen". Under the illusion of improvement and development, we only become enveloped by technologies and lose essential qualities of the human, such as the ability to be in time. The understanding of the human as fundamental technical being does not need to result in the understanding that technological improvement is equal to human improvement, as some transhumanists claim.

Conclusion of Stieglerian analysis of CRISPR/CAS

The above attempt to understand CRISPR/CAS from a Stieglerian perspective has shown its potential 'to do worse than the sheer destruction of humanity', but it has also acknowledged its curative potential and the human condition as 'originary technicity'. I will summarize the main points that were produced by the above analysis

Looking at our anthropogenesis, an immediate dismissal of CRISPR/CAS would be a misunderstanding of our nature, which is fundamentally technical. However, CRISPR/CAS does pose a threat to our self-understanding as 'accidental' and 'lacking', depending on how this is seen. If we understand accidental as the way we come into the world, and lacking as consequence of our physical characteristics, and we value both these concepts in our humanness, then the use of CRISPR/CAS could be argued to signify as sort of anthropological rape. However, the understanding of 'accidentality' could also be understood as 'having a past that is not lived'. We are always born in a mnemotechnical environment that was there before we were, we inherit an epiphylogenetic memory that we did not create individually. Our becoming is accidental from the perspective of the individual, who is thrown in a 'Weltgeschichte' that is out of his control. In that sense, we are always accidental, falling in technics, even though our physical constitution loses its randomness. If we see 'accidental' as the way human-technology relations come to be and 'lacking' as part of the experience that comes with being in time, then CRISPR/CAS ought to be permitted on the level of anthropology.

From the perspective of technology as a pharmakon, it all depends on the way we choose to imbed CRISPR/CAS in our society. The attention is turned away from biotechnologies and turns towards ourselves. How are we going to give shape to our world in such a way that we can harvest these positive potentials of CRISPR/CAS while we turn away from its malicious potential? The best way to stay clear of its destructive potential, is to understand what this technology could do and maintain a critical perspective towards these biotechnologies. CRISPR/CAS can be permitted from a Stieglerian perspective, on the precondition that we all become philosophers of technology. Or at least take steps towards understanding the potential of the pharmakon.

Our temporality is at stake when the use of CRISPR/CAS leads to the loss of the fundaments that cause us to be in time. Only, the fact that we came to be in time as the result of our lacking, does not mean our temporality will be lost when this lacking is technically compensated.

The mnemotechnical function of CRISPR/CAS is a pharmacological one. It could very well lead to adaptive practices, in which we adapt to CRISPR/CAS instead of adopting it on our terms. If we are too eager, our temporal mode becomes distorted and our possibility of asking questions becomes blinded by our greed for physical enhancement.

In terms of living the good life, it is most important to be amateurs as a creator of humans. This way, the 'making of new humans' will happen with the aim of loving them for their own sake, which ought to leave them with the most freedom to individuate themselves.

From the analysis of CRISPR/CAS from Stiegler's philosophical anthropology I can conclude that we should neither hurry to embrace nor to dismiss CRISPR/CAS technology. On the one hand, It is our condition to find ourselves falling in technics. However, an ill-considered embrace would overlook the pharmacological potential for destruction of this technology, which would also be a misunderstanding of our nature as technical. If we accept our technical condition too easily, we become in danger of de-individuation, a state in which we lose a critical perspective towards technologies. As long as we can maintain a critical look towards technics, and stay aware of its pharmacological properties, we may be able to continue developing technically.

However, the danger of CRISPR/CAS is aimed at the very possibility to remain in a position in which we can critically look at technics. For a danger so fundamental to our being, Stiegler cannot simply accept a pharmacological position, which may just as well go right as wrong. Because this danger is so serious for him, I am inclined to conclude that Stiegler would be against the use of CRISPR/CAS for influencing human evolution at this moment. But he is not principally against, nor does his philosophy imply he should be. His aversion of genetic engineering seems only temporal, because the human in his current state is lagging behind all technological developments, and is consequentially too much influenced by the control systems of the mnemotechnic system.

But not all hope is lost. If our non-technical systems ever catch up with the technical, the danger of CRISPR/CAS could be contained better. In order to get there, Stiegler has argued that everyone should become a philosopher of technology, which is "not a calling, but simply an act" (Stiegler, What makes life worth living: on pharmacology, 2013), and for which we would need a redesign of our educational system. (Stiegler, We moeten de quasi-oorzaak van het niets worden, van het nihil, 2015)

However, I am not sure if this Stieglerian analysis really addresses the critique of the bioethical discussion that I raised in the second chapter. In the following section I will compare his perspective

with the bioethical discussion and look at whether he really is able to provide an answer to the bioethical shortcomings.

2. A Stieglerian perspective in the bioethical debate

In this section I will reflect on whether Stiegler reaches the goal that was set at the end of chapter two. Does it really combine anthropology and human-technology relations such that the bioethical debate can be transcended? First, I will compare a Stieglerian point of view to the bioethical debate, then I will try to assign him a position in terms of bioconservatism or transhumanism, and finally conclude how useful Stiegler has been.

A Stieglerian perspective in the bioethical discussion

Here, I will revisit the ethical stances of bioconservatives and transhumanists that I used in chapter 2, which were: Intergenerational ethics, liberal rights, the moral case for benevolence, alienation thesis, and the protection of human nature. I will compare Stiegler's position to the positions that were provided in these arguments, in order to get him in the bioethical setting.

The first argument was that of intergenerational ethics on the bioconservative side and that of liberal rights on the transhumanist side. In my understanding, Stiegler would morally accept CRISPR/CAS as long as the other has freedom for individuation, but he is way too pessimistic about the actuality of this freedom to believe that it could happen. Stiegler not take a specific stance on the rights of the unborn. As long as each individual is designed for plurality, Stiegler will not have fundamental objections, but he does have objections following from a pessimistic risk-benefit analysis, in which the risk is 'worse than the sheer destruction of humanity'.

Considering the moral case for enhancement, Stiegler would understand the human condition of being in technics as the driving factor for using CRISPR/CAS. In this Stieglerian understanding, this is an anthropological fundament that leads to the use of CRISPR/CAS, but not a moral prerogative. Furthermore, in the bioethical discussion, there was a distinction made between therapy and enhancement, which does not come forward at all as a result of Stiegler's anthropology. If it is our condition to use technology to improve ourselves, it seems that enhancement is quite natural to us, because we are always lacking. Stiegler also breaks with transhumanist understanding of enhancement, which places technological enhancement equal to human enhancement as we saw in the former chapter. Stiegler has a much more spiritual conception of the human.

The protection of a 'Human nature' is a difficult point in Stiegler. First of all, the originary position of *accidental* is put to question when we have the ability to willingly choose characteristics. Even when we choose not to choose specific characteristics, this is a choice that defies the fundamental

accidentality of being human. From there and on our natural state is not to be 'geworfen' but to be 'gepostet', which roughly translates to 'be placed'. The difference between these words I attempt to clarify is the accidentality of where one 'lands'. When one is 'thrown' in the world, one undergoes a flight that is its own but uninfluenced by any deliberate force. When placed in the world, the freedom and randomness of this flight is lost and with it a 'freedom of ambiguity'. The anthropological position of such a being come into the world differs from that which was defined by Stiegler. He is no longer brought in his position by the accidental process of différance of nature, but its qualities chosen by human interference. The new man is no longer falling in technics as a necessary consequence of his originary accidental and lacking position. Instead, perhaps depending on the design, he has the freedom of being in nature without technics, or is created with the intention and ability to fit in the technical system. Being designed to fit in the technical system defies the concept of 'falling' in technics and replaces it with a 'destiny' of being in technics. In short, accidentality, chance, ambiguity is replaced by force and design. On the one hand he views technics as our condition, so to use them for our improvement is not intrinsically wrong. However, he shows himself more reluctant to accepting the use of genetic engineering than his anthropology implies. While one would expect a more neutral attitude towards technologies on the basis of his philosophical anthropology – they are pharmacological after all – he is much quicker to focus at all the danger that is poses and has no regard for its curative or positive potential. In 'Technoscience and Reproduction' he states: "… an impermeable characteristic of sexed living beings which constituted a causal law of the reproduction and evolution of the species, is *purely and simply suspended by the technoscientific invention of a new form of life...* Such is what we call the TECHNOSCIENTIFIC UPHEAVAL*."* (Stiegler, Technoscience and Reproduction, 2007, p. 32) That line seems to fit right in with bioconservative thinkers, yet Stiegler does not take the step to name this development morally wrong because it is not the development itself that is considered wrong. He focuses on the use of science as a tool to further the progress of technics, which is a typical post-industrial revolution mindset. But this should be understood as a danger primarily. To play with such dangers, in which the future of the human is at stake may be wrong, but that does not make CRISPR/CAS wrong in itself.

Finally, Stiegler's danger of the pharmacology of CRISPR/CAS is closely relatable to the alienation thesis. A large part of his work focuses on de-individuation, a de-singularisation of minds and the destruction of attention. The right way to live, savoir vivre, is at stake when we use CRISPR/CAS. There is a pharmacological danger in this evolution technology that threatens our ability to ask questions, which is of fundamental importance to Stiegler. His quarrel is not with the fact that we would have a changing conception of the human being; it is with the content of that conception.

Stiegler tries to warn us for the role technical reason takes on in producing a new conception of the human: the conception of the human as a product – which calls for the question of whether he really manages to depart as much from Heidegger as much as he claims, but that is perhaps for another story.

Stiegler: Bioconservative or Transhumanist?

With a philosophical anthropology that builds on 'originary technicity' one might have expected Stiegler to defend the transhumanist camp, but this has certainly not been the case. His arguments can be used to defend, or criticize both positions. He describes the human as fundamentally technical and sees that prostheticy is natural to us. On the other hand, the type of human nature that originates with the use of CRISPR/CAS does not quite hold the same anthropogenesis as the one that Stiegler builds on Andre Leroi-Gourhan. Furthermore, he heavily leans towards bioconservatism in his analysis of the danger of the pharmakon, although he never reaches the conclusion that these biotechnologies must be discarded, but comes really close.

In technoscience and reproduction he states: "One of the innumerable consequences is that the living being appears to the biotechnological industry as a *possible state of affairs* at one moment of evolution, a state that *nothing prohibits* to modify for the continuation of evolution by new means, those which are precisely *given by the control of the retentional devices, genetic material included.* " (Stiegler, Technoscience and Reproduction, 2007, p. 40) This is a good example of his position. His argument does not build on a pre-supposed normative 'goodness' in the pristine biological being, but on the pharmacological danger of the mnemotechnic function of technics. If left unattended, this techno-logic has the potential to irrevocably place the human in control of the retentional devices.

Ultimately, he distances himself from both perspectives. Stiegler has described posthumanism as a 'smokescreen' for de-individuation, but his anthropology of the human as fundamentally technical fits right up the posthuman alley that distances itself from 'old humanism'. He sees a specific relation between the human and technology – a transductive one – and aims to preserve all the knowledge, attentiveness, and individuation that it brings forth. In that sense, we may attribute him a middle ground with a 'biotechnical conservatism'.

However, this 'middle ground' should not be understood as a position right in between bioconservatism and transhumanism, because it simulatenously transcends the bioethical discussion on an anthropological ground. According to this new perspective both are wrong. By going deeper into anthropology, this Stieglerian perspective shines a new light on the bioethical debate about liberal Eugenics. The point that is made with this new perspective is that we should not be

wondering whether CRISPR/CAS will adapt humans in a good or a bad way, but how we can adopt this technology in a way we are comfortable with. How we can continue to live pharmacologically.

Is Stiegler the answer to the critique on bioethics of CRISPR/CAS?

In the second chapter I delivered two points of critique on the bioethical discussion. The first was a lack of explication of anthropological grounds, although they permeated their discussion. My second criticism built on posthumanist critique and argued that the bioethical discussion insufficiently understood human-technology relations by holding on to a fundamental split between humans and technology. In this section I will discuss whether Stiegler's philosophical anthropology and his normative understanding of human-technology relations provides an answer to these points of critique.

Stiegler and the connection between anthropology and normativity of evolution

Stiegler starts from a philosophical anthropology of technology and ends with a normative perspective on technology. He has done so by arguing that our temporal mode – how we experience the world qua time – is a pharmacological one. For Stiegler, this means that although our 'being in time' is fundamentally and necessary technical, it is at the same moment in danger of technicity. The danger of technology is the attack on the temporal mode. It is through Stiegler's conception of time that he manages to connect a philosophical anthropology to a normativity of technology, but not without assuming that certain temporal modes – the ones that enable individuation – are better than others. So yes, he does start from an anthropological basis which he builds out towards a normative perspective on technologies, but instead of his anthropological base itself, he seems to presuppose enlightenment ideals.

If we look at his anthropogenesis, the situation of the human as fundamentally technical is never violated. In Stieglers anthropology the 'becoming technical of life' and 'the exteriorization of memory' is fundamental to being human, even more than thought and being in time. From this perspective, why should he have a problem if our relation with technics results in less of a relation with time? After all, our essential human condition, being accidental in technics is not perverted and thus our human condition not betrayed. Nevertheless, Stiegler thinks this loss of being in time is an abomination. Perhaps this era of 'consciousness' is only a transitional era for the human that will end when the biological and the technical merge completely.

But for Stiegler this is unthinkable, and something of fundamental importance for the human, something that would degrade the quality of its existence, would be lost. Not only if we lose our situatedness in time, our temporality, but also a different temporal mode could mean this loss. And

our ‘technoscientific upheaval’ is a great danger to our temporal mode. Now, when the question of technology is more relevant than ever, the covering up of this question is the greatest danger.

Although I – and I would imagine many others with me – would prefer a life that is subjectively experienced, Stiegler’s anthropology does not value it specifically in his anthropology. He needs to lean on additional values that are not fundamentally part of his anthropological explanation of the human to make the case that genetic engineering has the potential for ‘worse than the sheer destruction of life’. The ill-considered use of CRISPR/CAS would gamble with an self-understanding that could be irreversibly lost, a self-understanding of relating to technics while simultaneously holding a critical perspective towards its mnemotechnical function.

Because evolution technologies such as CRISPR/CAS pose a danger to such fundamental values, Stiegler is disinclined to ‘live pharmacologically’ with such technologies that have the potential to redefine the human as fundamentally technical in the ‘wrong’ way. This wrong way does not maintain a critical perspective towards technologies and mnemotechnical control functions. The gambling with an irreversible human self-understanding by using CRISPR/CAS technology for the pursuit of evolution is too dangerous to just ‘live pharmacologically’ with it.

Stiegler and human-technology relations and CRISPR/CAS

In chapter 2 I criticized the bioethical discussion for its lack of attention to human-technology relations. In the following I will discuss if Stiegler’s work overcomes this critique. In Stiegler’s anthropogenesis, which is also an epiphylogenesis, the understanding of the localization and the direction of memory is crucial in order to understand the relation between humans and technologies. If an exteriorization is the case, this presupposes a pre-existing interior, but if interiorization takes place, a pre-existing exterior is required. Neither one could have come first because it presupposes the other already being there. Both interior and exterior are fundamentally linked in that they are one and the same.

> “It is not an issue of exteriority or interiority, because both presuppose the other. It is a question of originary complex in which the two terms are composed by one another. They are both the same, only considered from different points of view“. (Stiegler, Technics and Time 1: The fault of epimetheus, 1998)

The idea that interiority and exteriority are two sides of the same coin is fundamental to the human-technology relation that follows. Stiegler uses Simondon to explain technology in a transductive relation; “a prosthesis is not a replacement, but an addition.” (ibid, p.152) It is a relation in which both terms mutually make up one another, and neither can exist independently of

the other. So Stiegler manages to postulate a human-technology relation that rejects the dichotomous understanding of bioconservatives and transhumanists.

However, Stiegler has shown himself as defender of some sort of 'human-technology relation conservatism', in which there are only a few ways in which we can relate to technology in a good way. We must remain attentive, adoptive, individuals or we will fall in the nihilistic void of the proletariat. The management of our memory, specifically our internal capability to relate to our external memory, must be maintained to remain in a healthy 'human-technology' relation. But specific values such as attention and individuation do not justifiably roll out of this human-technology relation. For example, in eastern philosophy there is much more focus on collaboration of the group. And in the future, within a new mnemotechnical system, we may grow to value different ideals.

Stiegler tries to defend his values by claiming that they must be preserved for the sake of our temporality, but his argument is not convincing. Instead, I can only understand him as trying to hold on to a specific temporal mode. But temporal modes come and go. In the dynamic in which humans and technics co-evolve, our values change too. By hanging on to a specific relation to technologies to protect the temporal mode of the human, Stiegler does not quite lift himself out of the bioethical sphere. This 'political turn' is obscuring the understanding of the unique possibilities of CRISPR/CAS because it only focuses on the normative aspects within this temporal mode, but does not consider how the use of CRISPR/CAS for evolution questions the anthropology that gives rise to the normative understanding from which he attempts to condemn that very technology.

The central point in my critique is that Stiegler maintains a singular view on how humans maintain a critical perspective towards technologies, partly because it is possible to make an irreversible position that forever corrupts our human-technology relation. Instead, I would argue that the way in which we attempt to maintain a critical perspective towards technologies must be allowed to be dynamic, and also co-evolving in mutual shaping of human and technology. In this latter understanding we may allow the pharmakon to penetrate to the core of our biological being, while Stiegler would not allow it because the danger of the pharmakon is too serious to be allowed to change such self-understanding, and with it the regulation of a human-technology relation.

Chapter Conclusion

In this chapter I set out find a perspective that answers to both points of critique of the bioethical discussion and still manages to provide a normative answer on the use of CRISPR/CAS. I have used Stiegler's work to build from a techno-logical anthropology of the human which theorizes a transductive relation between the human and technics based on an accident, to a normative and anthropologic, exisitential, evalution of CRISPR/CAS.

In the first part of this chapter I analyzed CRISPR/CAS from a Stieglerian perspective. For this I built on central concepts of Stiegler's work; anthropogenesis, pharmacology, temporality, the mnemotechnic system and the good life. I concluded that CRISPR/CAS does pose threats to our self-understandng as 'accidental' and 'lacking'. From Stiegler's perspective, the use of CRISPR/CAS must go hand in hand with a 'politics of the mnemotechnic system' that stimulates human beings to become philosophers of technology. This act of philosophizing about technology is a necessary step for all social systems to catch up with technological development so that new technologies can be adopted and we can complete our 'epokhal rebloublement'. To reach this *'redoublement de redoublement'* we need to shift our *attention* to technologies, and see them and ourselves for what they really are; born from the same *accident* and fundamentally and originally intertwined. As I understood Stiegler, we can only then – when we correctly understand the potential of technics – face the danger that is posed by CRISPR/CAS. I have criticized this point of view because it does not consider that CRISPR/CAS influences the evolutionary anthropological understanding of the human that is giving rise to the objection against it.

In the second part of this chapter I compared this Stieglerian perspective to the bioethical debate of the second chapter. I had hoped to overcome both points of critique that were raised in the second chapter by taking this Stieglerian perspective, which builds on an anthropology of a transductive relation between humans and technics, and in a way he did. Stiegler provides an anthropological base, from which he builds towards a normative perspective on technologies. Furthermore, this anthropological base recognizes the fundamental entanglement of humans and technology, by positing the exteriorization of memory (through technics) as the origin of the human (and technics). So both points of critique are fairly addressed by Stiegler, but I am not satisfied in the way in which it happens. I have argued that Stieglers connection between anthropology and normative thought is weak and that he leans strongly on a specific human-technology relation, which is required for a normative 'being in time'. This 'biotechnical conservatism' turns very political, which leads him to be unable to entirely escape the bioethical discussion, which results in a moderately nuanced view regarding the influencing of our evolution with CRISPR/CAS. Unfortunately, Stiegler has been unable to take into account how fundamentally CRISPR/CAS

relativizes his own philosophy. As a result, Stiegler seems to have lost 'the question of technology' when he takes his own philosophy as a starting point for his arguments, rather than the technology that confronts it. Certainly now that human evolution could be influenced by the use of CRISPR/CAS, a revision of our evolutionary anthropology – a new area of paleoanthropology in the anthropocene – ought to be incorporated in the analysis of CRISPR/CAS.

All in all, the plan to come to 'rules for the human zoo' that fully incorporate the mediative characteristics of CRISPR/CAS has not completely succeeded by using the philosophy of Bernard Stiegler. Although he has provided very interesting ideas about the normativity of the co-evolution of humans and technologies, his philosophy is too unwilling to put itself in perspective of its own temporal mode. As a result, it has been too conservative to be able to think *with* the technological developments – or envelopments – that shape how we perceive these very developments. Although it recognizes that this process happens, and that these technologies do pose a danger to it, the possible consequences of this pharmacological situation are too severe for Stiegler to be able to 'ride the storm'. With this I mean that he perceives too much danger to argue to give shape to the process while it happens, and instead calls for a 'halt' of technological development, so that all other systems may catch up with the technological system.

In the next chapter I will look at ways to find a middle road between Stiegler and mediation theory. A technology as fundamentally disruptive for human self-understanding in relation to technology as CRISPR/CAS requires a perspective with more focus on evolution, and the understanding of our own evolution. More specifically, it requires a perspective that can deal with the technological mediation of our anthropological self-understanding.

Ch. 4 Anthropo-ethics for evolution technics: rules for the human zoo

Journey before destination

- Brandon Sanderson in 'The Way of Kings'

In the last chapter I analyzed CRISPR/CAS from a Stieglerian perspective, focusing on our prosthetic condition, our being in time, the pharmakon, and a politics of technology. This analysis was a great response to the bio-ethical discussion, but did not quite lead to the level of abstraction that I required to reach conclusions to guide the responsible use of a technology as disruptive as CRISPR/CAS.

In this chapter, I will first reflect on this critique on Stiegler with postphenomenology to explicate how anthropology and ethics should be combined in the case of evolution technics, and how we should understand the role of human-technology relations in this perspective. I will argue that even our self-understanding is technologically mediated. Then I will use a Stieglerian perspective to add a normative line to postphenomenological thought, which would otherwise be left in a 'normative void'. In the second part I will combine these three pieces of the first part into a single anthropo-ethical perspective on technology and optimize it for the analysis of CRISPR/CAS by taking into account the specific intricacies of analyzing a technology for the use of influencing evolution.
Finally, I will work to a conclusion of anthropo-ethical 'rules for the human zoo' to answer the main question of this thesis: under what social, political, and existential conditions can the human influence human evolution by means of CRISPR/CAS from an anthropo-ethical perspective?

1. Stiegler and postphenomenology

In the following sections, I will use Stieglerian and postphenomenological philosophy to answer to critiques on both sides. I aim to combine these three sections into a single anthropo-ethical perspective in the second part of this chapter.

Postphenomenological improvement of Stiegler

In the last chapter, I critized Stiegler for having a weak connection between his anthropology and his ethics, and for defending a 'human-technology relation conservatism', in which his focus on the rational, intelligence, and individuation come forward as conservative compared to more pluralist ideals. Such a realist approach to values is opposed to the idea that our values are continuously mediated in our transductive relation with technics. It is exactly this plasticity of values that Stiegler

refuses to accept for fear of a total proletarianization. In this section I will come back at both points of critique I concluded in the last chapter to confront them with postphenomenological critique.

First, I will discuss the connection between anthropology and ethics by confronting Stiegler with postphenomenological mediation theory. Although 'classic' mediation theory focuses on the mediation of morality and values, I aim to expand it with a mediation of self-understanding; anthropological mediaton, which is made possible by evolution technologies such as CRISPR/CAS. Instead of a mediation between the human and the world, I attempt to describe the technological mediation between the human and himself.

Second, I will address the critique on the conservative human-technology relation posited by Stiegler. I will do so by looking at the *relation* to the human-technology relation. Certainly from the understanding that humans and technology exist in relation to each other, we can take an ex-centric position from this relation, in which we can relate to our human-technology relation. I will argue for the importance of relating to our human-technology relation for the possibility of making responsible decisions.

Mediation of Anthropological self-understanding and Ethics

In 'Human nature in the age of Biotechnology', Tamar Sharon sets off against dystopic, liberal, radical, and methodological posthumanism to make the case for mediated posthumanism, from which to understand how we should relate to our human-technology relation.

> "What is needed is a mediated posthumanist approach which can incorporate both the non-humanist notion that the subject is technologically mediated, i.e., an understanding that humans are in part constituted by their technologies, and the understanding that the subject can actively relate to, or help shape these mediations. An ethics of technology that can offer a framework for assessing emerging enhancement and biotechnologies in this perspective is not about protecting humanity from the threat of technology, but about explicitly shaping technological mediations, taking advantage, so to speak, of technology, in order to shape the way in which we are constituted as subjects in a desirable manner." (Sharon, 2014, p. 233)

In the aforementioned book, Tamar Sharon concludes that "both technology and biology are given, but given as starting points, that mediate what it means to be human." (Sharon, 2014) I would like to proceed on this line of thinking. It implies that not our current understanding of our anthropology should be our starting point, but the relation between biology and technology. So, if technology

challenges our current ideas of anthropology, we should reconsider our anthropological self-understanding.

In this perspective, the relation of anthropology and morality is not found in a causation in which morality flows out of the anthropological understanding of the human, as I suspected at the start of this thesis. Instead, both are connected in the understanding that both are technologically mediated.

We have seen in the former chapter that Stiegler only thinks of a single origin, in which everything happens in the single move of life becoming technical. That is for him the only origin of the human and everything that is developed in the human afterwards, is only a result of that first and only origin. This has appeared to be a weak spot in the attempt to connect anthropology to ethics because Stiegler's normative perspective concerning the pharmacology of technologies relies on the conception of humans as intelligent, temporal beings that are able to ask questions. However, these characteristics are only indirectly valued as a consequence of being in technics, but don't seem to have any fundamental value according to his philosophical anthropology.

The central idea of mediation theory is that technologies mediate how we perceive the world. (Verbeek P. P., 2011) So to say, human-world relations are mediated by technology. As a result, our morality is mediated by technologies because we come to see the world in a different way. In '3rd wave philosophy of technology', technologies mediate morality by standing between the human and the world. However, the rise of new biotechnologies has changed this dynamic, biotechnologies now stand so close to human cognition that now it is a 'human-technology hybrid' that discloses the world, as would be the case with CRISPR/CAS-altered perception. (Olsen, Evan, & Riis, 2009)

The world that is disclosed trough technologies does not only contain other humans that are understood as moral beings, but also the self is disclosed, as anthropological being. In other words, technologies do not only mediate morality, but also mediate anthropological self-understanding. One of the most interesting aspects about the anthropo-ethics of CRISPR/CAS is that the being that is created is different on fundamental anthropological grounds, and thus cannot be understood in terms of our own anthropology anymore. At least, not in the terms of the Stieglerian anthropology that was explicated in the last chapter.

When our anthropological self-understanding is questioned by new technologies, there are two directions that seem possible. We can change technological development to fit our current understanding of our anthropology, or we can change the understanding of our anthropology, to fit technological development. But this is not a choice we can rationally make. How we come to see ourselves is partly internalized memory from those very technologies that challenge our self-understanding. This is exactly the point of technologically mediated anthropology, that it has already happened before we can decide anything about it. It is only from this new position that we can

retrospectively look back, but in already understanding ourselves in a new way, one cannot decide to understand himself as one did before. Consequently, a new technology cannot be denied from the anthropological self-understanding that itself has shaped.

Relation to the human-technology relation

My second point of critique on Stiegler was that he is some sort of 'human-technology relation conservatist' because he is invested in a specific temporal mode, which I claimed to be informed by an unjustified realist conception of enlightenment values. By sticking to this specific temporal mode as the only way in which humans should relate to technology, he is unable to think how humans and technologies can morally develop together – and develop morality together. Here, I will argue for the importance of the way we relate to human-technology relations, and use this understanding to provide an alternative for this Stiegler's temporal mode.

I will start with addressing the paradox of ethics of technology from a transductive human-technology relation. If, as Stiegler's anthropology suggests, life is fundamentally technical, it seems paradoxal to execute an 'ethics of technology'. If technology is so natural to us that it even precedes thinking and temporality, would we not be in self-denial to question the morality of technologies? If technologies are pharmacological, and I am what I am because of the epiphylogenetic memory of these technologies, is it not impossible to be ethical? Can we even take a meta-position that analyses humans and technology if that position is already interwoven with technology?

It seems we must overcome the problem of technology being the *unthought* of philosophy, as Stiegler has pointed out. But if being in technics even precedes human thinking, this means we cannot think without influence of technology – as our prosthetic condition demands – then we are always too late and we can only think after the fact (*epimetheia*) of being shaped by our third memory. Every position of thinking is then already affected by the technology at question.

However, this being aware of always-already being influenced by the mnemotechnical system is the first step to seeing it in perspective. Now that we have become aware of this dynamic of human-technic co-formation, we can make further steps towards a perspective on technology by incorporating the understanding that an entirely unmediated perspective is impossible. To repeat a quote from Foucault: "Freedom is the human ability to relate to that which influences him". (Foucault in Verbeek, 2011, p. 56) So in order to be free – which is a requirement for being responsible for our choices – we must understand how we relate to technology. But we must not only realize that the human shapes technologies and technologies shape the human in their transductive relaton, but also acknowledge that both humans and technologies shape the [understanding of] the human-technology relation:

> "But it is Foucault's attention to the subject's *relation to this relationship*, as the primary target of his ethics, that is particularly useful for thinking through the hopes and fears raised in posthuman discourse…Here, the subject actively engages with the technological mediations that help constitute it. Its actions are not simply the result of a technological determination but of an active appropriation, or the "stylizing" of these mediations." (Sharon, 2014, p. 168)[emphasis in original]

So in order understand technology, we must not only consider technology, 'the unthought of philosophy' as Stiegler claims, but also our relation to the human-technology relation. For the case of CRISPR/CAS, we must ask not only how this technology mediates our perception of the world, but also how it mediates our understanding of human-technology relations.

Helmuth Plessner understood the human as ex-centric, because we can relate to ourselves, as if from a position outside of ourselves. In that way, the posthuman must also reach an ex-centric position outside his hybrid combination of human and technology. From this ex-centric position, in which the 'centric' is understood as a human-technology hybrid, the posthuman must be able to reflect on this human-technology relation.

Stiegler would likely not accept such a plastic understanding of the human-technology relation for fear of de-individuation and the alienation of what is human that it brings. To such critique Sharon states: "On the contrary, they [biotechnologies] create an obligation to act in the present by adopting an informed and prudent relation to the future. Thus the genetically responsible subject emerges within a framework of new obligations towards moral decision-making, self-actualization and responsibility to others, and the understanding that one can have an active relationship with the technological mediations that help constitute the self" (Sharon, 2014, p. 233).

In order to be able to hold this position, we must accept ourselves as evolving, continuously changing beings, with no fixed anthropological self-understanding, fixed morals or specific human-technology relation. We can only conclude that an ethics of evolution technology must also incorporate the relation to human-technology relation, on top of only the human-technology relation.

Stieglerian addition to mediation theory

In the first part of this section I used postphenomenology to critizice Stiegler for being too explicit about his normative consideration of the human in relation to technology. In this part I will turn the critique around, and argue that postphenomenology is too 'meta' to come to any pragmatic moral stance from which to consider conditions for the use of CRISPR/CAS. I will use Stiegler to add a normative line to mediation theory.

I will first sketch what I consider to be the problem with the combination of mediation theory and the ethical evaluation of technologies. Then I will use Stiegler to provide a direction for technological accompaniment, even 'from within'. I aim to do this through Stiegler's understanding of the technological constitution of temporality, temporal modes, and memory . First I want to link the understanding of technology as a tertiary memory to mediation theory. Building on these similarities, I will connect mediation theory to temporality, in the same that technology as a tertiary memory gave rise to temporality. Continuing on that train of thought, I will explain our temporal mode in terms of mediation theory and technology as tertiary memory. Having drawn these parallels, I will argue for the normative value in the possibility of being able to stand in relation to our temporal mode. Or in terms of mediation, that there is normative value in the possibility to relate to our mediative human-technology relation. This is an existential normative because this relation is not critical for staying within a specific mode – which I argue has no value – but it is critical for the possibility of being in a temporal mode, it is necessary for temporality itself – and thus for being human.

The problem with technological mediation theory and ethics of CRISPR/CAS

The essence of the problem with mediation theory is that it does not allow a position from which we unmediated can state which values or direction of accompaniment is good. In *Moralizing Technology,* Verbeek argues that finding ourselves in this mediated position should encourage us 'to take responsibility for our technologically mediated existence'. (Verbeek P. P., 2011, p. 158) However, taking responsibility implies having the intention to act justly, and our understanding of what is just is exactly what is being mediated. The aforementioned words of Sharon are no help either when she claims postphenomenology is about "explicitly shaping technological mediations, taking advantage, so to speak, of technology, in order to shape the way in which we are constituted as subjects in a desirable manner." But it is exactly the problem of mediation theory that what we consider 'desirable' is already technologically mediated.

In 'Beyond checklists: toward an ethical-constructive technology assessment' the authors already recognize the impossibility of an 'ethical (constructive) technology assessment' because any

assessment already requires a position outside of technological mediation, which it claims is impossible. Therefore, they argue not for an *assessment*, but an *accompaniment* of technologies, 'from within'. (Kiran, Oudshoorn, & Verbeek, 2015) But the question still remains; an accompaniment to where? If we may believe Stiegler's critique on contemporary consumer capitalism, this may well be an accompaniment towards total proletarianization and de-individuation, an accompaniment to becoming 'das Man'. And we still lack an objective position from which to determine the direction of this 'accompaniment' because we are always already mediated.

A normative line in Technological Mediation Theory

As we saw in the former chapter, Stiegler understands the 'exteriorization of memory' as the core of the 'coup' that led to the emergence of both the human and technics. The human learns to understand the world through technologies that form its tertiary memory. In a similar way, mediation theory describes that human-world relations are shaped through technologies; technologies mediate our perception of the world. As such, technologies, who are external, play a fundamental role in the internalization of information. A small difference with Stieglerian philosophy is that he considers technologies already as tertiary memories, while mediation theory focuses on the role of technologies is in the internalization of, and interaction with, the world. However, both theories describe a situation in which our understanding of the world is mediated by technologies.

For the next part of my argument I will build on Stiegler's understanding of 'being in time', which for him is only possible by being in technics. Through the availability of tertiary memories – epiphylogenetic memory – we turn outside ourselves and come to experience time. In terms of technological mediation, that would mean that only by being technologically mediated in the world, we *uncover* the world as a temporal world; structured in time. In this sense, technological mediation is a necessary condition for the ability to reflect on technological mediation because it provides the experience in time in which we can understand mediation. In mediation theory, the world is always already mediated which bars us from a clear perspective. That same process is described by Stiegler as a 'temporal mode'. We are not 'simply' in time, we are always in time in a specific way that is formed through the internalization of our exterior memory; technics.

Although I have already criticized Stiegler for his normative stance in which he attempts to hold on to a specific temporal mode, the normativity of temporality –the possibility to find ourselves in a temporal mode – has not yet been addressed. Before any temporal mode can represent a normative position – which we require for the 'accompaniment' of CRISPR/CAS – it must first be shaped by our access to temporality itself.

This access to temporality is given by our 'being in technics'. Simultaneously, mediation theory requires that – whatever the normativity of a temporal mode prescribes – in order to make responsible decisions, we must be aware that our human-world relation is technologically mediated. As I argued in the first part of this chapter, we must stand in relation to human-technology relations to be able to make responsible decisions. We must accept that any decision is already mediated, made within the perspective of a temporal mode. However, the possibility to see ourselves in this position is of existential importance, and therefore of normative importance too.

Therefore I argue for a 'normativity of temporality' which aims to see our temporality as a normative good, which is also an existential good because being in time is necessary for the human experience of life. Second, not only our temporality is a normative good, but the dynamic of our temporal modes, the ability to relate to this mediation, to stand in relation to our tertiary memory, should be seen as a normative good because it is only possible to take responsible decisions within a specific temporal mode that fosters the freedom to do so.

In this sense, I am unable to say anything about the specific direction accompaniment of CRISPR/CAS, other than that it must happen within the confines within which we remain to be in time, for which we need to remain to be able to relate to technologies and human-technology relations. Within these boundaries, CRISPR/CAS should be accompanied according to the values the current temporal mode gives rise to. In this dynamic, our normative and anthropological self-understanding is continuously subject to technological mediation, which results in the change of this self-understanding. And that is completely fine. As long as humans hold on to their ability to relate to their human-technology relation, they can participate in responsible accompaniment of technologies. Only from the freedom that we acquire by relating to our human-technology relation, we can manage to influence our own evolution, rather than being influenced by it.

2. The best of two worlds

In the first part of this chapter I suggested how postphenomenology could add something to Stiegler and Stiegler something to postphenomenology. In this part I will explicate a middle position between Stiegler and postphenomenology and fine-tune it so that it can incorporate the unique dilemma that the influencing of our own evolution brings. I will start by summarizing the points I made in the first part of this chapter. Two of these were aimed to improve the Stieglerian perspective and one to improve the normativity in mediation theory.

In the first part I argued that we should incorporate technology as a tertiary memory in the way we would responsibly give shape to ourselves. There I argued that we should see the human as having a dynamic moral and anthropological self-understanding, opposing Stiegler's techno-

pessimism that focuses on the potential catastrophe of CRISPR/CAS. Secondly, I argued that we should not look solely at the human-technology relation, but at the relation humans have to that human-technology relation. This again sets off against Stieglerian conservatism because it allows humans to move closer to temporal modes that Stiegler finds destructive. However, it does only do so within the framework that the human is able to relate to its human-technology relation, maintaining a distance to it, so that it is never completely 'swallowed up'. Finally, I used Stiegler to add a normative line in postphenomenological mediation theory. I argued that human experience of temporality should be seen as a normative good, and thus worthy of protection. Insofar technologies function as epiphilogenetic memories that give rise to the experience of time, they are subject to ethical consideration. However, this counts for temporality, and not necessarily for a temporal mode. This relation to time is necessary to maintain the possibility of a human relation to the human-technology relation.

An anthropo-ethical perspective on evolution technics

I will combine these three points into a single anthropo-ethical perspective that is specifically aimed at analyzing the specific dilemma of evolution technologies. This dilemma is the double shaping of the human, in both his genetic and epiphilogenetic memory. The tricky part about influencing evolution is that it simultaneously influences our genetic memory by changing the genes out of which we are build, and our epiphilogenetic memory, that affects our moral and anthropological self-understanding in relation to technology. Not only CRISPR/CAS technology, but even our bodies, as technologically produced bodies, may have an epiphylogenetic function that mediates our self-understanding.

Anthropo-ethics and evolution technics

The 3 ingredients that followed from the first part were: technologically mediated anthropo-ethics, a focus on the human relation to the human-technology relation, and the normativity of the possibility of relating to that human-technology relation. But the issue of influencing evolution through CRISPR/CAS complicates this even further. How can we possibly come to a normative guidance of our own evolution if we must accept that 1) our anthropological self-understanding and ethics are mediated by CRISPR/CAS and 2) we must consider ourselves as evolving, changing beings with no fixed temporal mode, only with the moral goal for the ability to relate to that relation? Is it than even possible to come to ‘conditions under which we can influence human evolution by means of CRISPR/CAS?' Is all that philosophy can do is look out from its ivory tower and merely observe the beauty of our changing values, self-perception, and understanding of our human-technology relation that is brought about by our continuous interaction with technology?

It may seem than every position one can take from this anthropo-ethical perspective devalued because of it is relativated to its current mnemotechical environment, and it is impossible to make any claims on what is good. But that is not the point, the point I try to make is that although any position we take within the anthropo-ethical framework is understood as mediated, and relative to a technical environment, it is still the perspective that follows from our human condition, and it is the most sensible thing to act according to it. However, it does require the ex-centric position of understanding one's own moral and anthropological beliefs as relative to one's technological environment.

In the anthropo-ethical perspective, both ethics and anthropology give rise to the understanding of technology, human, and human-technology relations. Furthermore, the mutual constitution of moral and anthropological self-understanding must be taken into account, and the technological mediation of both. This leads to a plastic perspective which takes a normative perspective on a technology such as CRISPR/CAS, but simultaneously acknowledges that this specific point of view is technologically mediated, and this will change over time. It thus accepts that a position is taken on a 'good' use of technology, but does not claim any moral realism or anthropological truth on that position, merely on the possibility of that position. It does claim an absolute moral good on the possibility of relating to having an technologically mediated perspective and an anthropological truth of finding ourselves in relation to technology.

How can we make sure to protect our temporality? Are there no absolute moral or anthropological values that must remain untouched? Surely, some uses of this technology that would condemn its' 'products' to live an unworthy life must be prohibited. That is why I argued against the plural design of groups for the sake of evolution that was defended by Sorgner in the second chapter, and for the plural design of individuals. But what is considered as malicious and what not, is also technologically mediated. A communist philosophy may be much more inclined to argue for the specialization of humans, while a liberal philosophy would favor a broader range of individual capabilities.

In the following and final part of this chapter, I will use this perspective to reach to 'rules for the human zoo'. I will attempt to get as close to get as close to the line of thinking, and being able to come to moral judgment from the temporal perspective, rather than anything within a temporal mode.

3. Anthropo-ethical rules for the human zoo

In this final part of this chapter I will analyze the use of CRISPR/CAS for the influencing of human evolution from the anthropo-ethical perspective I explicated in the former part of this chapter. I will

describe the anthropo-ethical conditions within which we can pursue as 'rules for the human zoo'. I will discuss these on two levels. First on the level of temporality, which is a condition of possibility for influencing human evolution. Second on the level of the temporal mode, in which I argue for more pragmatic rules for the human zoo.

Conditions of possibility for influencing human evolution - Temporality

The only condition that we require to influence human evolution by means of CRISPR/CAS I can rightfully claim at this point, is the condition that we have had since the very start of our anthropogenesis; the technical condition. More specifically, we require a relation to this technical condition. An understanding of the human position as always being mediated by technology is a necessary requirement to responsibly accompany technology, even though the conception of what 'responsible' is, is already technologically mediated.

In the case of CRISPR/CAS, the responsible accompaniment of technology is immediately a double shaping of the self. First through its mediate character of our 'anthropo-ethical' self-understanding and second through the influencing of our own evolution. I want to stress that if we want it to be the *human* that is the one influencing its own evolution, he must be able to relate to his human-technology relation. After all, only someone who is free to do so, can act responsibly. And as I argued above with Foucault, postphenomenology, and Stiegler; one must be aware of his human-technology relation to have this freedom. So the condition of possibility for *influencing* human evolution *by humans* is the following:

> The influence of human evolution by means of CRISPR/CAS must happen within the condition in which the human understands himself as a being in relation to technology, and uses this insight to responsibly shape himself, within which he needs to hold on to his perspective in which he understands himself as a technologically mediated being.

From the anthropology on which I build, the human is only human when he is in relation to technology, but that does not yet explain why he needs to be able to *relate* to that relation. This requirement has specifically arisen because the inquiry into CRISPR/CAS led to the point of anthropological mediation. Because it hooks into our self-understanding as anthropological *beings,* aside our self-understanding as *moral* beings. The ability to re-design ourselves and our self-understanding must come with the freedom to see ourselves in our relation to technologies. This has shown a necessary point to maintain our position as temporal beings. This temporality has been argued as an absolute normative good.

Condition within the temporal mode

Here, I will look at more pragmatic 'rules for the human zoo'. Although our anthropo-ethical self-understanding is mediated by technology, we still have the responsibility to think about how we want to give shape to ourselves, literally and figuratively. Because we always already find ourselves within a mediated position, this is the only option. First I will discuss *how* we can promise a future in which we maintain our temporality, while simultaneously working to change our biological bodies. Secondly I will discuss the political process in which the influence of human evolution could take place. Thirdly I will discuss social problems and issues with the anthropo-ethical perception of individuals.

The condition of possibility for the future within a temporal mode

I have argued that it is necessary to relate to the human-technology relation when we would go as far as influencing our own evolution by means of CRISPR/CAS, in order to be able to act responsibly, and have any freedom to influence our evolution. But the problem is that we always can only do so from a mediated position. The question here, is then of an education – a continuation of memory – that maintains the possibility of relating to our human-technology relation. So how can we act prudential to the future?

Stiegler is rather pessimistic about that future: "the 'intellectuals', those who claim to think, with the current technology, are not able to produce other models than those who are currently provided by consumerism." (Stiegler, We moeten de quasi-oorzaak van het niets worden, van het nihil, 2015). Following Tamar Sharon, we should take advantage of our mediated position; create the right epiphilogenetic memory, mediating technologies, which aid in this process. Although Stiegler may argue that we need to wait with further technological development until our social and political systems have caught up with the technical, I would say that we need to accompany the current technological development with more technologies that are specifically aimed at, and appreciated for, their ability as tertiary memory. There will be no 'epokhal' doubling up. We have never waited for it, nor should we now. The human lives in the condition of 'riding on the storm' of technology. But it would be a misunderstanding of ourselves to contain the 'storm' (technological progress), we are just forced to become better riders of it. [4] Thus, CRISPR/CAS should be accompanied by educative technology that is designed to teach us to maintain the ability to relate to our human-technology relation.

[4] It would be appropriate to play 'Riders on the storm' by 'The Doors' in the background as you contemplate the human condition of always finding himself falling in technology.

Political rules for the human zoo: Royal anthropo(techno)logy

The conclusions above describe how the individual should understand, and relate to, CRISPR/CAS, in which he must have the freedom for anthropological self-understanding, the freedom to form his own technology-mediated values, and the understanding of himself as a changing being who can relate in different ways to its human-technology relation. But that does not seem to give much guidance for 'royal anthropologists' on the use of CRISPR/CAS. How should we deal as a society with these different values? We make laws to confine behavior within certain limits, but what process should give rise to the laws concerning CRIPSR/CAS?

As discussed in the first chapter, evolution is not a matter of the individual; it concerns a whole group of humans. The decision to allow an influence of evolution concerns more than the liberal individual who makes the decision, and should therefore happen within certain legal limits. But the question of Sloterdijk remains: what should these rules be and who should make them? Heilinger has argued that a only a democratic process should give rise to the making of such rules, yet it should be a debate that is open to a continuous development of understanding what it means to be human: "the debate about the normativity of what it means to be a human being must be an open and opening debate, not a closing one." (Heilinger, 2014) The political debate must take up anthropological understanding and human-technology relations as a subject of debate. Then, through informed consent, civilians can partake in the democratic process through which the course of influencing human evolution is decided.

In practice, this means that everyone is entitled to their own view on anthropology, but only democratic decisions should lead to the legalization of the use of CRISPR/CAS for evolution, and more specifically the framework in which our self-design should take place. In western societies, this implies a democratic process. So when a collective understanding of the human being – or at least the understanding of the human being of the parliament that represents this collective – has come to such an understanding of our anthropology and morality that the human may pursue evolution, then it should be accepted.

However, this should not be seen as an absolute truth, but only the path within the current technologically mediated understanding of ethics and anthropology. It may well be possible that other socio-political systems have a different view and will thus choose another path. Decisions on the influence of evolution by means of CRISPR/CAS can only be made within the contemporary technologically mediated frameworks of political self-understanding. To say anything more specific would require a debate in political philosophy, possibly a debate in which one tries to connect this

anthropo-ethical perspective to a political philosophy. But such discourse will have to deal with fascist or totalitarian regimes and dictatorships.

Social anthropo-ethical 'Rules for the human Zoo'

The changing anthropo-ethical self-understanding unearths social dynamics and issues of the role of mind, body and identity. While I have gone along with a philosophical critique of mind-body dualism in the second chapter, a certain distinction between mind and body for the appreciation of individuals will be vital. When values will be ascribed to genetic traits we need to prevent any social system that values persons according to their physical characteristic. We must not make the mistake to identify a person as his or her body, or genes. We must separate the ghost from the shell. Simply said, we must prevent any discrimination based on genetic make-up.

But this is again in my understanding from a western liberal perspective. Perhaps a successful communist society is thinkable in which each individual is happy to be discriminated and given a fitting role in society, according to their genetic make-up. As implied earlier, social systems will continuously change along with technological change and vice versa. The anthropo-ethical perspective requires a freedom to act responsibly, which requires understanding oneself as a being in relation to technology, and mediated by it. But this does not necessarily imply a liberal society. In other words; the theory so far focuses to place and accompany CRISPR/CAS in *human* lives, but has not been sufficiently developed to argue that they need to be good, or fair, human lives.

Chapter conclusion

In the first part of this chapter I used postphenomenology to address the two weak points that I encountered in the work of Stiegler at the end of the third chapter and used Stiegler to improve the moral void in mediation theory. First, I looked at the weak connection between his anthropology and ethics. Through mediation theory I argued that the one is not a result of the other, as I had expected earlier, but that both are connected in that they are technologically mediated. The second weakness was that of Stiegler's 'human-technology relation conservatism' because he holds on to a specific temporal mode. Looking at human-technology relations in postphenomenology led to the conclusion that these human-technology relations should not be used as a normative argument because they are continuously given form by new technologies. Instead, we must accept ourselves as evolving, continuously changing beings, with no fixed anthropological self-understanding or specific human-technology relation. I did argue normative value of that meta-position. Then, I used Stiegler to argue for a normative line in mediation theory. I did so by arguing for a normative value of the meta-position of seeing ourselves in relation to technics, which I argued is necessary for having the freedom to make responsible decisions.

In the second part I combined the Stieglerian and postphenomenological improvements into an anthropo-ethical perspective. In this perspective, the technological mediation of anthropological and moral self-understanding is divided in terms of temporality and temporal mode. For temporality, I argued for a normative good of being in relation to our human-technology relation. Within the temporal mode, I put forward that any accompaniment of CRISPR/CAS can only happen from within a technologically mediated perspective, but that we nevertheless attempt to accompany technology as best as possible. Not because that specific accompaniment will be good, but because the act of accompanying is good, and an anthropological necessity.

Finally, I aimed to answer the research question of my thesis, under what social, political, and existential conditions can the human influence human evolution by means of CRISPR/CAS from an anthropo-ethical perspective? On the side of temporality, I concluded that the influence of human evolution by means of CRISPR/CAS must happen within the condition in which the human understands himself as a being in relation to technology, and uses this insight to responsibly shape himself, within which he needs to hold on to his perspective in which he understands himself as a technologically mediated being. On the side of the temporal mode, I concluded CRISPR/CAS should be accompanied by educative technology that is designed to teach us to maintain the ability to relate to our human-technology relation. We should actively design our tertiary memory to incorporate an awareness of, and relation to, the mediated human-technology relation. On the role of politics I concluded that decisions on the influence of evolution by means of CRISPR/CAS can only

be made within the contemporary technologically mediated framework of political self-understanding, but I did not manage to say anything specific about which political theory should be favored. Finally, there is the point of social dynamics, and the danger of identifying human beings in a social context with their genetic make-up. So to say, the technological mediation of our 'anthropo-ethical' self-understanding requires a social response to the understanding of this dynamic. The anthropo-ethical perspective I put forward has not yet been developed enough in that direction to be able to condemn a specific possible future. The theory so far aims to place and accompany CRISPR/CAS in *human* lives, but has not been sufficiently developed to argue that these need to be good, or fair, human lives.

This conclusion finds itself on a more abstract level than the bioethical discussion took place, and encourages both positions in that discussion and their effort to understand the human being. Only through such a continuous process of understanding the human being in relation to the technologies that challenge our current understanding of the human, can we accompany technological and human development.

Thesis Conclusion

At the start of this thesis set out to find out under what conditions we can pursue human evolution through the use of CRISPR/CAS technology. From the ideal of evolution we went to technology to improve upon the slow biological processes, for which we looked at ethics to allow it to work and finally turned to anthropology to understand why. I concluded that if we are to answer this question, we must combine the understanding of all of evolution, technology, ethics, and anthropology into an 'anthropo-ethics of evolution technics' to be able to understand the workings of CRISPR/CAS.

In the second chapter I looked at the bioethical discussion for answers but I concluded that, for an ethics of humans and technologies, their understanding of humans was insufficiently explicated, especially in relation to technology. What I required was a clear anthropology that acknowledges the human relation to technology.

In the third chapter, I took a look at the philosophical anthropology of Bernard Stiegler, which could be used as an anthropological basis which connects to a normative perspective on technologies, from which CRISPR/CAS9 could be analyzed. Unfortunately, even this Stieglerian perspective turned out to be flawed. In a weak connection between his anthropology and ethics he is stuck in a singular perception of a right temporal mode that does not allow a plural understanding of technologically mediated anthropo-ethical self-understanding. This leads to a very pessimistic view on technologies such as CRISPR/CAS.

In the final chapter I turned to postphenomenology to overcome these weak points in Stiegler. Investigating the weak connection between anthropology and ethics led to the insight that both are technologically mediated, and the inquiry into Stiegler's single human-technology relation led to the meta-perspective that we ought to relate to our human-technology relation, which in itself should not be used as a normative basis. In turn, I used Stiegler to argue for a normative approach in technological mediation.

Finally, I concluded there are no fundamental anthropo-ethical objections to the use of CRISPR/CAS for the influencing of human evolution. But there are some conditions. I concluded that the influence of human evolution by means of CRISPR/CAS must happen within the condition in which the human understands himself as a being in relation to technology, and uses this insight to responsibly shape himself, within which he needs to hold on to his perspective in which he understands himself as a technologically mediated being. To reach this, we must, from our already mediated position, use the meditative properties of our external memories for the education of ourselves, and the future, to maintain our position in which we can relate to our human-technology relation.

Although this can only happen from within a temporal mode, and there is no objective position possible from which we can be certain that our decisions are good, we must attempt it anyway because only through continuous self-defining and self-understanding will the human evolve; socially, politically, technologically, and biologically.

Discussion

This conclusion has some interesting possibilities, implications and weaknesses that I'd like to discuss further here. I will discuss this conclusion in relation to the bioethical discussion of the second chapter, what the potential role of philosophy of technology can be, and some weaknesses in the theory.

Anthropo-ethical perspective and the bioethical discussion

In the end, none of the arguments in the bioethical discussion on liberal eugenics has taken part in the final conclusion. Likely, this is because my focus turned towards human-technology relations and mediation, which are both unaddressed in this discussion. As a result, my conclusion regards only temporality, not the specifics of the temporal mode. This means that it focuses on the possibility of remaining in relation to technology, in which any anthropological and moral self-understanding is only relative to the tertiary memory of that time. But simultaneously, it is required to be aware that that is the case, in order to participate in responsible accompaniment of technologies. Only from the freedom that we acquire by relating to our human-technology relation, we can manage to influence our own evolution, rather than being influenced by it.

My conclusion also differs from the bioconservative perspective because it accepts a dynamic anthropological and moral self-understanding. Where for example Habermas argues that 'our very moral self-understanding is at stake', the point of the anthropo-ethical perspective I put forward is that that should not be considered morally good or wrong.

What can Philosophy do?

Marx once said: "The philosophers have only interpreted the world, in various ways. The point, however, is to change it." (Marx, 1888) What can philosophy of technology contribute to make sure that humans stay able to relate to their human-technology relation? We don't have to go as far as making everyone a philosopher of technology as I half-seriously concluded from Stiegler, but we can help our philosophy connect to society by making it understandable so that people can make informed decisions based on their understanding of our anthropology, ethics, and their relation to

the human-technology relation. Here, philosophy of technology has a role to play in education, and needs to figure how it can use technologies to inform society.

Potential problems with these 'rules for the human zoo'

Stiegler has called genetic engineering as having the potential 'to do worse than the sheer destruction of humanity'. In the solution I put forward, this danger will indeed always be there. Where we must always keep our temporality in mind from the perspective of a temporal mode – from within – we are always at risk of losing this connection. I think we should develop with CRISPR/CAS nonetheless, because the alternative would already be to give up the human beforehand for me. Our lives can after all only be lived pharmacologically, to use Stiegler's words against him. But that does place the human in a difficult position, always falling in technics and always having to 'ride the storm' of technological development.

There's also a social issue I would like to mention. Freedom of anthropological self-understanding may bring similar problems as the freedom of religion. When we take anthropology as the most fundamental understanding of what is human, and different theories make different claims on our fundaments, then strive could break out – for example when different anthropologies reach different conclusions on the evolution of the human. We then seem to have moved on very little from the bioethical discussion.

Furthermore, there is an issue of double anthropology in my anthropo-ethical perspective. On the one hand the anthropology of 'being in technics' is seen as an absolute truth and has a moral realism attached to it. While on the other hand, an 'anthropological self-understanding' that is technologically mediated only see such anthropological and moral self-understanding only as relative to its environment. It feels arbitrary to call the former 'true' and the latter 'relative'. I could only argue this because I took technology as the fulcrum on which this theory hinges, but since that fulcrum is also the subject of this theory, I have the feeling it is not entirely waterproof.

Finally, there is the issue of using CRISPR/CAS to solve social problems. It is questionable whether they can address the issues at stake. For example, by removing genetic varieties such as Down's syndrome or other forms of genetic deviations from the gene pool, we do not address the issue of inequality. We merely (temporarily) shove it under the carpet. We would be expecting too much of technology if we think it can address such social problems.

Recommendations

I have several recommendations in which this research could continue.

Anthropo-Ethics

I believe to have laid a base to connect philosophical anthropology with ethics of technology, which could be used for further interdisciplinary analysis of technology. I think future research could build on this thesis in several directions. It would always be worthwhile to look at CRISPR/CAS from different anthropological perspectives, or to look at different technologies with the current framework.

Education

For working towards the future, I would recommend to start research into an educational plan that introduces some form of philosophy of technology to society, to make it 'CRISPR/CAS ready' – or 'future-ready' in general. It will be challenging to try to use technology to help to get a grip on technology, and to make sure it does not

The animal in the human

The 'animal' part of our nature receives little attention in Stiegler. We are 'life become technical', but first and foremost we are life. Stiegler seems to imply that technics precedes everything about the human, but there is something fundamentally in life that is not preceded by technics. Love, feelings, emotions, 'irrational' thoughts, those are the things that were already in the animal, the living, before he became technical and thus human. I think it would be valuable to look into these aspects of the human, and perhaps connect them to notions such as individuation.

Evolution with Technics

I have mainly focused on evolution of the mostly biological, in which understanding of the human is changed but the human remains a biological entity. However, the influencing of our own evolution could go different directions. We could change our biological selves to literally connect better to technologies. We could change the make-up of our brain cells so that they better connect to electrodes, so that technology and biology can meet each other somewhere in the middle. I believe a reconsideration of this theory with such potential – to design the human for the restrictions of technology – in mind will be valuable.

Thesis Reflection

Retrospectively, I think I should have started this project with a clear outline of inquiry that would have allowed me to have concluded that the path I chose at the start was not ideal. Instead, I just wanted an answer and kept my path open and adjustable in order to be able to find a sensible answer, which really did not help to narrow this project down.

When starting this thesis, I had no idea what my conclusion I would reach, but I had certainly not expected the conclusion I reached at the end. I had expected to arrive at a much more tangible conclusion, which would very pragmatically say what types of actions or uses of CRISPR/CAS would or would not be allowed. In hindsight, I'm rather happy to have reached such an abstracted conclusion because I do not think that I would have been able to defend anything more concrete against accusations of totalitarianism or anthropological fascism. Yet somewhere, it is a little unsatisfying to deliver a conclusion that is so abstract. While writing this thesis, I have often asked myself: building on this logic, would I say that Hitler was wrong? And certainly towards the end, where I took a meta-ethical position and made the point that any conception of morality is technologically mediated by the 'zeitgeist' and our tertiary memory of that moment in history, I found it harder to make this absolute claim based on the theory I produced. Still, one can argue that within the mediated morality of that time, he acted against the commonly accepted norms, which makes his 'wrong-doing' only relative to his environment. Yet still, I would have liked to come to a more concrete and 'tangible' conclusion that takes a stronger stance against immoral acts.

I'm still not sure what I personally think of the genetic engineering development. The mind already has been technologically mediated, and as such our perception of the body. But the body itself always remained something pure, and although technologies are used to account for all its lacks and even help determine what we consider as lacking, the physical constitution of the body had always remained out of the realm of technological intervention. I cannot deny that the technological penetration of this domain fills me with some unease, yet to the idea of refraining from this development appeals to me even less.

References

Agar, N. (2004). *Liberal Eugenics.* Blackwell Publishing.

Benedictus, R. (2002). *Eugenetica in Nederland*. Retrieved from Nemo Kennislink: http://www.nemokennislink.nl/publicaties/eugenetica-in-nederland

Berra, T. M. (2008). Charles Darwin's paradigm shift. *The Beagle, Records of the Museums and Art Galleries of the Northern Territory*, 1-5.

Bostrom, N. (2005). In Defense of Posthuman Dignity. *Bioethics*, 202-214.

Bostrom, N. (2005). Transhumanist Values. *Review of Contemporary Philosophy*.

Bostrom, N. (2009). The Future of Humanity. In J. K. Berg Olsen, E. Selinger, & S. Riis, *New Waves in Philosophy of Technology* (pp. 186-215). Hampshire: Palgrave Macmillan.

Cartledge, P. (2001). *Spartan Reflections.* London: Duckworth.

Coeckelbergh, M. (2013). *Human beings @ Risk.* Springer.

Darwin, C. (1859). *On the Origin of the species.*

Darwin, C. (1871). *The Descent of the Human.*

Development, C. o. (2011). *United Nations*. Retrieved from http://www.un.org/press/en/2011/pop994.doc.htm

Enriquez, J., & Gullans, S. (2015). *Evolving Ourselves.* New York: Penguin Group.

filosofie.nl. (1999, 9 13). *Sloterdijk botst met Habermas; richtingenstrijd binnen Frankfurter Schule*. Retrieved from Filosofie: https://www.filosofie.nl/nl/nieuws/2487/sloterdijk-botst-met-habermas-richtingenstrijd-binnen-frankfurter-schule.html

FindLaw. (n.d.). *Wrongful Birth and Wrongful Life Lawsuits*. Retrieved from FindLaw: http://injury.findlaw.com/medical-malpractice/wrongful-birth-and-wrongful-life-lawsuits.html

Galton, F. (1908). *Memories of My life.* London.

Habermas, J. (2003). *The Future of Human Nature.* Oxford: Blackwell Publishing.

Harris, J. (2007). *Enhancing Evolution.* Woodstock: Princeton University Press.

Heilinger, J.-C. (2014). Anthropological Arguments in the Ethical Debate about Human Enhancement. *Humana Mente Journal of Philosophical Studies*, 95-116.

Hitler, A. (1925). *Mein Kampf.*

Humanity+. (2009). *Transhumanist declaration*. Retrieved from Humanity plus: http://humanityplus.org/philosophy/transhumanist-declaration/

Institute, G. (2016, May). *Characteristics of U.S. Abortion Patients in 2014 and Changes Since 2008*. Retrieved from Guttmacher: https://www.guttmacher.org/report/characteristics-us-abortion-patients-2014

Institute, G. (2017, Januari). *Induced Abortion in the United States*. Retrieved from Guttmacher: https://www.guttmacher.org/fact-sheet/induced-abortion-united-states?gclid=CJmajZm0sM4CFZSIaQodAlMH1A

Jinek M, C. K. (2012). A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. *Science 337*, 816–21.

Kass, L. R. (1997). The Wisdom of Repugnance. *The New Republic*, 17-26.

Kass, L. R. (2003). Ageless bodies, Happy Souls: Biotechnology and the pursuit of perfection. *The New Atlantis*, 9-28.

Kiran, A., Oudshoorn, N., & Verbeek, P. (2015). Beyond checklists: toward an ethical-constructive technology assessment. *Journal of Responsible Innovation*, 5-19.

Latson, J. (2016). *What mararet Sanger Really said about eugenics and Race*. Retrieved 2016, from Time: http://time.com/4081760/margaret-sanger-history-eugenics/

Laurence, M. (1993, January 22). *What is Evolution?* Retrieved from Talk Origins: http://www.talkorigins.org/faqs/evolution-definition.html

Ledford, H. (2016, March 7). *CRISPR gene editing is just the beginning*. Retrieved from Nature: http://www.nature.com/news/crispr-gene-editing-is-just-the-beginning-1.19510

Lemmens, P. (2008). Bernard Stiegler. In P. Lemmens, *Gedreven door Techniek* (pp. 379-436).

Lemmens, P. (2008). Gedreven door techniek. In *Driven by Technology* (pp. 379-430). Box Press.

Lemmens, P. (2008). *Gedreven door Techniek.* BoxPress Uitgeverij.

Lozier. (2015). *Lozier institute*. Retrieved from https://lozierinstitute.org/wp-content/uploads/2015/05/On-Point-An-Analysis-of-How-Medicaid-Expansion-in-Alaska-Will-Affect-Abortion-Rates-Michael-New1.pdf

Marx, K. (1888). *Eleven Theses on Feuerbach.*

McKibben, B. (2003). *Enough: Staying human in an Engineered Age.* New York: Times Books.

Nash, O. *Come, Come, Kerouac! My Generation is Beater Than Yours.*

Nations, U. (1948). *Declaration of Human Rights.* Retrieved 2016, from http://www.un.org/en/universal-declaration-human-rights/

Nu.nl. (n.d.). *Percentage echtscheidingen recordhoogte*. Retrieved from http://www.nu.nl/binnenland/2758063/percentage-echtscheidingen-recordhoogte.html

Olsen, J.-K. B., Evan, S., & Riis, S. (2009). *New waves in philosophy of technology.* Palgrave Macmillan.

Page, M. L. (2016). Retrieved from New Scientist: https://www.newscientist.com/article/2115635-fish-rapidly-adapt-to-pollution-thousands-of-times-lethal-levels/

Powell, R. (2012). The Future of Human Evolution. *Brit. J. Phil. Sci*, 145-175.

Rawls, J. (1971). *A Theory of Justice.* Cambridge: Massachusetts: Belknap Press.

Roberts, B. (2007). Introduction to Bernard Stiegler. *Parallax*, 26-28.

Rousseau, J.-J. (1973). *Les Confessions.* Paris.

Sandel, M. J. (2007). *The Case Against Perfection.* Harvard University Press.

Sander, J. D., & Joung, J. K. (2014). CRISPR-Cas systems for editing, regulating and targeting genomes. *Nature Biotechnology*(32), 347–355. doi:doi:10.1038/nbt.2842

Sen, A. (1989). Development as Capability Expansion. *Journal of Development Planning*, 41-58.

Sharon, T. (2014). *Human nature in an age of biotechnology.* Maastricht: Springer.

Sholl, J. (2014). *Evolution and Normativity.* Leuven: KU Leuven.

Sloterdijk, P. (2009). Rules for the Human Zoo: a response to the Letter on Humanism. *Environment and Planning D: Society and Space*, 12-28.

Sorgner, S. (2013). Human Dignity 2.0: Beyond a Rigid Version of Anthropocentrism. *Trans-Humanities 6(1)*, 135-159.

statistics, D. (2009). Retrieved from http://www.divorcestatistics.info/divorce-statistics-and-divorce-rate-in-the-usa.html

Stiegler, B. (1998). *Technics and Time 1: The fault of epimetheus.* Paris: Standford University Press.

Stiegler, B. (2004, May 13). *Bernard Stiegler: Culture and Technology*. Retrieved from Tate: http://www.tate.org.uk/context-comment/video/bernard-stiegler-culture-and-technology

Stiegler, B. (2007). Technoscience and Reproduction. *Parallax*, 29-45.

Stiegler, B. (2010). Reprodcution, selection and adoption in the epoch of the industrial pharmakon: the new critique of life. In B. Stiegler, *On Pharmacology* (pp. 127-130). Paris: Polity Press.

Stiegler, B. (2012). Relational Ecology and the Digital Pharmakon. *Culture Machine, 13*, 1-19.

Stiegler, B. (2013). *What makes life worth living: on pharmacology.* John Wiley & Sons.

Stiegler, B. (2015, January 28). We moeten de quasi-oorzaak van het niets worden, van het nihil. (J. W. Buseyne, Interviewer)

UNGA. (1948). *Universal Declaration of Human Rights.* Paris.

Verbeek. (2007). The Technological Mediation of Morality - A Post-Phenomenological Approach to Moral Subjectivity and Moral Objectivity.

Verbeek, P. P. (2011). *De grens van de mens.* Rotterdam: Lemniscaat.

Verbeek, P. P. (2011). *Moralizing Technology: Understanding and Designing the Morality of Things.* University of Chicago Press.

Verbeek, P.-P. (2005). *What Things Do.* Philosophical Reflections on Technology, Agency, and Desgin. Pennsylvania State University Press.