Chapter 3

I DON'T WANT COMFORT, I WANT GOD, I WANT POETRY, I WANT REAL DANGER

by Theo Boer and Cees Dekker

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In this chapter, we present a Christian reflection on 'human enhancement'. After a brief overview of converging technologies, especially those at the interface of living and lifeless matter, we comment on some popular future scenarios related to human enhancement – from overly optimistic 'transhumanists' to 'doomsday prophets' – and we provide arguments for a more nuanced debate. We emphasize the difference between medical research aimed at restoring 'normal' human functioning, and human enhancement that explicitly targets to expand the normal human capacities. While biblical faith offers a strong theological license to develop and use new technologies, we criticize technologies aiming to 'enhance' humans beyond their natural capacities. If this is even feasible at all, the intention to do so implies a mistaken pretence to be able to set the destiny of the human species. Properly seen, 'human enhancement' is a theological concept which in our opinion can only be realized at the level of moral virtue and a pious relationship with the living God.

3.1. Introduction[1]

A few years ago, the New Scientist asked a number of top scientists about their expectations for the coming 50 years.[2] These were some of their answers: by using artificial eggs and sperm cells, engineered from the body cells of both parents, virtually all babies will be born without genetic defects; new medications will enable the human body to regenerate limbs that got lost due to illnesses or trauma; with the use of brain stimulating medications, humans will be able to have new mystical experiences and to face their mortality without fear; the human mind will be extended with implantable, organo-electrical brain-machine interfaces; portable devices will lead to new approaches to developing therapies for cognitive diseases such as schizophrenia, autism, depression and Alzheimer's; psychologists will be able to use imaging devices that will tell us what is going on in the brain as we make judgments, take decisions, negotiate with one another and form expectations and intentions; nonbiological computer intelligence will be a trillion times greater than the combined intelligence of all human brains and in the end humans will merge with the tools they have created; all this also implies the risk of abuse, such as implanting erroneous thoughts in the minds of others and influencing their preferences and decisions.[3]

More than eighty years back, Aldous Huxley published his famous book *Brave New World*.[4] This novel sketches a terrifying world in which genetic engineering has yielded a merciless and manipulative class society. Human life is regulated from its artificial beginning to its swift, assisted end. What was previously considered adventurous and valuable is replaced by a shallow and riskless existence of happy drugs and superficial sex. At first glance, it is an agreeable world without conflicts, infirmities, guilt, or shame. It is a world in which every need finds instantaneous satisfaction, a world of multimedia top amusement and quasi-religious rituals induced by a 'soma' pill.

Characteristic of this and other views of the future is a lack of the very things that make human life worth living to most of us: loving relationships that survive 'in good and bad times'; satisfaction that is attained through enduring exercise; fulfillment that is preceded by years of patience; a capacity to deal with complex moral choices; solidarity and belonging to families and communities; the beauty of art, music, and literature; the virtues of courage, modesty, honor, obedience, commitment, qualities that are attained only through lifelong learning. It is the absence of these human characteristics which makes Huxley's optimized new world such a frightening one.

Perhaps the most horrifying aspect is that Huxley's *Brave New World* is the result of conscious and voluntary human choices. In George Orwell's novel *1984*, the state controls its citizens by exerting violence and inflicting pain. In *Brave New World*, however, there is no need for coercion: the quest for a healthier, more comfortable and happier life suffices to do the job. One of the world leaders in the book keenly observes that seduction proves to be far more effective than violence and coercion. Although the new world is established through science and (bio)technology, its theme is not so much science and technology itself, but the ways in which human choices and technical developments are interconnected and the role played by psychology and morality. Human choices and aspirations yield new technologies, which, in turn, influence future choices and aspirations.

Aldous Huxley situated his *Brave New World* in about AD 2500. In 1947, fifteen years after it was published, Huxley observed that the progress of science had been even more rapid than he had anticipated. On observing this fast pace, he said he expected the horror world of his *dystopia* to be within reach in only one century rather than five.[5] Indeed, remarkable progress has been made with regard to some of *Brave New World's* central technical pre-requisites. Information technology, genetics and neurosciences yield a steadily increasing range of possibilities to influence the fate of humanity.

What is the public response to these technological developments? Many applications, such as medical diagnostic or data storage devices offer promising possibilities without causing any controversy. On the other hand, we see public debates about the possibility

that nanotechnology or synthetic biology might sooner or later have detrimental side effects.[6] Could nanoparticles, for all the advantages they have, perhaps become the asbestos of the future? Will the ever extending internet applications become a threat rather than a safeguard to the privacy of their users? With the help of new technology we will be able to prevent genetic diseases – but what about the potential dangers of eugenics (racial selection) and Huxley's fears of a post-human class-society? Will we end up in a society in which only human beings without handicaps will be accepted?

The dreams and fears attain an extra intensity and poignancy when it comes to the borders and limits between life and lifeless, between humans and machines. What will the effects be of interconnections between computers and the human brain for our self-understanding as humans? What if we become able to artificially create life from lifeless material? Will we be able to control potential negative effects? Some people suggest that Homo sapiens is on its way to evolve into an enhanced *Homo technicus*, a superhuman whose technical, mental, and physical capacities reach way beyond the capacities of present day humans, and who might one day even conquer *Homo sapiens*. One cannot help wonder: is that true and if so, will there be a way back once we discover disadvantages?

These are some of the many questions that arise from the advance of science and technology. In this chapter we provide a brief reflection on these, focusing on human enhancement. This chapter is written from the bi-disciplinary background of science and ethics. We will first briefly describe some of the accomplishments and prospects of recent technologies (section 2). Next, we highlight different reactions to these developments in human enhancement: from fear to cheer, and everything in between (section 3). After some remarks on the vocabulary of enhancement (section 4), we then make a number of specifically Christian ethical remarks (section 5). Subsequently, we illustrate our reflection by looking at a concrete example: assisted procreation (section 6). Finally, we will come back to where we began, to Huxley's *Brave New World* (section 7).

3.2. Converging Technologies

The stakes are high in the so-called 'converging technologies': nanotechnology, robotics, information technology, neuroscience, genetics, biotechnology – different research areas with increasingly frequent encounters, overlaps, and shared purposes. These fields are rapidly evolving, providing ever more new applications that open up novel future perspectives. Nanotechnology constitutes techniques that enable us to manipulate matter at the level of single atoms and molecules – an approach that can be used for basic research involving the building blocks of matter, not only of all lifeless but also of all living materials. The impact of information technology is obvious to anyone, with ever cheaper

computers and ever increasing communications. Genetic modification, which has been practiced for decades, is now experiencing a drastic increase in its technical capabilities, leading into a new field called synthetic biology.

Many of the accomplishments are impressive. We have, for example, seen remarkable progress in the area of technical devices which help restore deficient body functions. The pacemaker has been used for more than half a century (in 1958 the first fully implantable pacemaker was developed). Contact lenses and hearing aids, used by a considerable part of the population, may in the future be localized inside the body. Through surgery a cochlear prosthesis can be implanted in the middle ear. With this electronic device, which is activated by a microphone worn outside the ear, partial hearing can be regained by individuals with severe to profound hearing loss. The device bypasses damaged parts of the auditory system and directly stimulates the central nerve of hearing.[7] In a similar way it is becoming possible to implant optical chips (the light sensitive CCD element of a camcorder) into the eye and to connect it to the nervus opticus. The first results are encouraging: persons with a complete loss of view are now able to discern some form of light.[8] Retinal implants are currently being developed, which partially restore vision to people who have lost their vision due to degenerative eye conditions such as retinitis pigmentosa or macular degeneration.[9] Interestingly, a more 'natural' alternative may be developed in the form of retinal regeneration but this form of bioengineering is currently still in a much earlier stage.

Even more spectacular is the option to connect computers to nerves in the human brain, enabling humans to operate machines solely by their thoughts. Certain forms of brain activity can be monitored by using an MRI-scan. Implanted electrodes are able to sense brain activity with such an increased accuracy that the recorded signals can function to operate a cursor on a screen or to make a mouse click. Matthew Nagle (1979-2007) was the first person to use a brain-computer interface to restore functionality lost due to paralysis. He was a C3 tetraplegic, paralyzed from the neck down after being stabbed. Aided by the brain-machine interface, Nagle was able to open his emails, play simple computer games and operate the remote control of his television set – all of that controlled solely by his thoughts![10] The connection can also operate in the reverse direction – from machine to the brain. Experiments with rats have shown that their movements can be influenced by humans typing a command on a keyboard which, through electric signals to electrodes in the brains of the rat, can predispose the rat to perform certain actions, such as jumping.[11] With the use of new technology brain signals can, therefore, both be sensed and be operated.

Zooming in to the smaller scale, the nonvisible level of molecular biology, we observe that genetics has made enormous advances in the last decades. In genetic recombination

techniques, part of the DNA of one organism can be transplanted into the DNA of another. By adding genes to the hereditary material of a micro-organism, plant, or animal, new genetic characteristics are added. In genetically modified corn, for example, the DNA is changed through the addition of a gene from a bacterium that produces a substance poisonous to insects, making the corn resistant to insect plagues. On a large scale, genetically modified micro-organisms are used for the production of chemicals and medications. Similar techniques could, in principle, be used for repairing genetic defects in the DNA of humans. Until now, attempts at gene therapy were only partly successful but the prospects are getting better. Technically, there is little difference between repairing a defect gene and adding a 'foreign' gene. The same technology that is used in gene therapy can be applied in order to add genes from plants and animals to the human DNA, if that is deemed useful for some purpose.

At the molecular scale, the differences between 'living' and 'lifeless' are blurred and ill-defined. Although even the simplest living bacterial cell is hugely complex with many hundreds of components, the understanding of the molecular cell components and their interactions is growing at a fast pace. This raises expectations that scientists in the near future, say in 10 years from now, will succeed in constructing biological complexities that will result in the construction of life-like cells. It is not unrealistic to assume that humans thus may be able to artificially construct life.[12] A new discipline, called synthetic biology, engages both in redesigning natural biological systems for more efficient use and in designing and synthesizing new biomimic components.[13] An underlying idea is that it is possible to engineer biological systems from genes and proteins, analogous to the construction of a computer chip from components such as transistors. And indeed, many new genetic circuits have already been built and found functional in cells.

This fascinating research field provides a new perspective on living structures, a bottom-up engineering approach that is different from the traditional perspective of biology. At this moment, researchers are busy composing catalogues of biological building components and trying to build complex biological structures by using these components.[14] To name just one example, a genetic network was designed and constructed which builds in a day-and-night rhythm in bacteria that do not originally have such a circadian rhythm. And by combining genes of a fungus, plant, and other bacteria, researchers have cultivated bacteria which can produce an affordable medication for malaria.

Because of its enormous scientific and application perspective, funding for research in the areas of the converging technologies is sizeable. For example, the European Community announced in early 2013 that 1 billion euro (!) will be awarded to two projects – the Human Brain Project which plans to use a supercomputer to recreate everything known about the human brain, and Graphene which plans to research the potential of an ultrathin,

conducting form of carbon for applications in computing, batteries and sensors.[15] In the Netherlands, a 51 million euro subsidy was granted by the Netherlands Organisation for Scientific Research to a project, initiated by one of the authors of this contribution, that sets out to explore the frontiers of nanoscience, both the quantum world in materials as well as the building blocks of living cells.[16]

3.3. Between Utopia and Dystopia

How should we evaluate these developments?[17] Some voices are unequivocally positive. In 2002 the renowned American science organization NSF organized a workshop entitled, 'Converging Technologies for Improving Human Performances'.[18] Its organizers Mihail Roco and William Bainbridge predicted that by the year 2022 a revolution would have occurred in the way we work and produce. Broadband connections between the human brain and machines will change the ways we work, drive and relax. Sensors and computers will increase the level of human consciousness. Robots will have all the positive characteristics of hard work of humans (purposiveness, creativity, etc.), however without the disadvantages and limitations of human labor. Before the end of the 21st century, Roco and Bainbridge predict 'world peace, universal prosperity and evolution to a higher level of accomplishment and compassion'.

Roco and Bainbridge are not alone: the Oxford philosopher Nick Bostrom and the futurist Ray Kurzweil propagate a philosophy named transhumanism.[19] They proclaim that we have both the means and the obligation to structurally improve the human condition by using genetic modification and other techniques. With unreserved optimism they predict that in the future humans will feature increased intellectual, physical and psychological capacities and will no longer be bound by some of our present-day biological limitations. Humans in their present form merely represent a transitional stage of the evolution (hence the term, transhumanism), the next steps being the enhancement of humans by gene- and nanotechnology and an integration of humans and computers.

Other voices, by contrast, present a doom scenario. According to Bill Joy (co-founder of Sun Microsystems), intelligent robots may in the end prove to be a stronger species than humans – causing the latter to gain at some stage the doubtful status of endangered species.[20] According to Martin Rees, the renowned British cosmologist and astrophysicist and former president of the *Royal Society* in London, there is a reasonable (50/50%) chance that, as a consequence of possible malign or accidental release of destructive technology, the 21st century may be *Homo sapiens'* last century.[21] Francis Fukuyama expresses a similar pessimistic tone. In his book, *Our Posthuman Future,* Fukayama sketches a brief history of humankind's changing understanding of human nature: from Plato and Aristotle's belief that humans had 'natural ends' to the ideals of utopians and dictators of the modern

age who sought to remake humankind for ideological ends. Fukuyama argues that the ability to manipulate the DNA of all of one person's descendants will have profound, and potentially terrible, consequences for our political order, even if undertaken with the best of intentions.[22]

C.S. Lewis, the British apologist and one of the greatest thinkers of the 20th century, similarly wrote already in 1943 in *The Abolition of Man:*

> *"In reality, of course, if any one age really attains, by eugenics and scientific education, the power to make its descendants what it pleases, all men who live after it are the patients of that power. … But then within this master generation (itself an infinitesimal minority of the species) the power will be exercised by a minority smaller still. Man's conquest of Nature, if the dreams of some scientific planners are realized, means the rule of a few hundreds of men over billions upon billions of men. … The final stage is come when Man by eugenics, by pre-natal conditioning, and by an education and propaganda based on a perfect applied psychology, has obtained full control over himself. Human nature will be the last part of Nature to surrender to Man. The battle will then be won".* [23]

And Leon Kass, who chaired the US President's Council on Bioethics (the major commission in the field of bioethics in the US) from 2001 to 2005, emphasized the importance of these questions in an interview:

> *"All of the boundaries are up for grabs. All of the boundaries that have defined us as human beings, boundaries between a human being and an animal and between a human being and a super human being or a god. The boundaries of life, the boundaries of death. The normal human relations that are founded upon the ties born of sexual reproduction, as a result of which every child is the fusion of two lines going back to time immemorial. We may be able to do new things, but it will no longer be clear who is the 'we' doing them – whether enhancing athletes' bodies through steroids, changing who you are with euphoriants, moving the maximum life expectancy out so that one no longer lives with the vision of one's finitude as a guide to how one chooses to spend one's days, or blurring that ultimate line of what is a human being and what is an animal. These questions are the questions of the 21st century and nothing is more important".* [24]

The responses noted meander between overly optimistic and deeply pessimistic. We are convinced of the value of, and need for a more nuanced approach. In Europe and elsewhere there is a growing awareness that we may be equally wrong in demonizing converging technologies and portraying them as 'technological molochs' which cannot be halted, as in hailing them as the panacea to all problems connected to the *condition humaine.* In 2006, the European Community organized a workshop on the new converging

technologies under the title 'Converging Technologies in the 21st Century: Heaven, Hell, or Down to Earth?'[25] Given the fact that many debates focus on the extremes, the suggestion to bring the discussion 'down to earth' and to explore the golden middle road of sober-minded and realistic reflection was a valuable one. Converging technologies provide us with great power, but like so many technologies before, do not come with a user's manual. This gives our present-day generation the responsibility to reflect wisely and soberly, with regard both to the factual possibilities and risks of these technologies, and to the objectives and intentions that motivate and direct their development. The risks and dangers should not be exaggerated; but neither should their potential blessings and breakthroughs.

3.4. Human Enhancement Terminology

'Human enhancement' is a loaded and somewhat confusing term. Anyone who observes the discussions will notice the absence of agreement on the precise meaning of the term 'human enhancement.' To some, 'human enhancement' refers to *any* attempt to make human life more liveable, comfortable, and healthy; to others, the term is restricted to attempts to make substantial and lasting changes to the human species beyond what is today considered 'normal' and 'natural.' Beyond this, there are also deep differences about what can be expected and achieved in the future by means of new technologies.

On the one hand are the transhumanists who stress the dawn of a new species of superhumans; on the other hand doomsday prophets who predict the demise of the existing human species. Interestingly, despite their radically different messages, the extremes seem to agree that converging technologies mark a dramatic shift in humankind's history. This shared assumption may have to be challenged. To be sure, the technological developments are there. Some of them are impressive, and no doubt more breakthroughs will follow. But the assumption that converging technologies will radically alter the fate and identity of humankind, for better or worse, may be a bit too much of a tribute to humans.

When we use the term, 'human enhancement' in a more modest way, however, the question is: why use it at all? The CEC discussion document describes human enhancement as "ways to make functional changes to human characteristics, abilities, emotions and capacities, beyond what we regard today as normal, using advances in biology, chemistry, physics, materials, information technology and the mind sciences".[26] According to yet another, broader definition, human enhancement refers to "any attempt to temporarily or permanently overcome the current limitations of the human body through natural or artificial means".[27]

In both cases, questions are in place. With regard to the 'broader definition,' the question

is: what's new? Have humans not *always*, throughout history, attempted to 'make functional changes to human abilities'? Have they not continually tried to 'overcome the current limitations of the human body through natural or artificial means?' In a certain respect there is little new in the aspirations of humans to improve their strength, lifetime, achievements, etc. What is the use of redescribing all these attempts in terms of human enhancement? And, with regard to the CEC definition: how realistic is it to expect that humans will be able to make structural and lasting enhancements to members of their own species, i.e. changes that do not fall within the range of capacities already present in some exceptionally talented human beings? Transhumanists claim that it is possible to transcend our present biological limitations by increasing our intellectual, physical and psychological capacities. They proclaim that humanity is at the threshold of an 'extreme makeover' which may include many kinds of improvements, from a superhuman IQ to enhanced senses and increased muscular power, and from the use of body-machine interfaces to the global use of germ line genetic modification. These predictions should at least be rated as speculative and questionable.

Historically, humans have certainly made drastic improvements in their living conditions. Mortality rates in developed countries have plummeted; life expectancy continues to go up; the people's average height has gone up by almost a foot compared to that in the Middle Ages; the level of education is higher than ever before; numerous technological developments continue to widen the range of possible courses for human activity. However, all these improvements have to do more with changing conditions and circumstances, than with changing the 'essence' of humans. And there are no indications that this progress in technical improvements is connected to changes in the human genome in any major way.[28]

Of course, changes in the human genome may occur. Many Christians are convinced that God has used evolution as the primary tool to create life,[29] and He may continue to use evolutionary processes to enhance his creation. At the same time some people may be sceptical of the 'enhancement-claim.' Have not some of the greatest atrocities in history occurred in the recent history of modern humankind, and could this not be indicative of a moral degeneration of the human species rather than an evolution for the better? Are we, by taking care so well of people with genetic deformities, not eliminating evolutionary mechanisms, and could this not mean that the genome of the human species will, on average, deteriorate rather than improve? Such arguments may or may not be conclusive; they may not even stand the test of scrutiny; but they have to be seriously considered.

In all of history so far, the focus in medicine and in medical science was on restoring deficiencies in the physical and mental health of humans up to a 'normal' or 'natural' level. Most of the medications we use and the surgery we undergo are directed at this

aim. When we wish someone a 'speedy recovery' or pray that she may 'get better,' what we do is to express the hope that her natural, healthy functioning will be restored. There has also been a strong emphasis on preventing deficiencies. By using folic acid and refraining from an unhealthy lifestyle, women hope to protect an embryo from developing genetic deformities. Couples with an increased risk of hereditary diseases may want to prevent the birth of a severely handicapped child, either by refraining from getting pregnant altogether, by using pre-implantation diagnostics for selecting a healthy embryo, or by using prenatal diagnosis in order to be able to end the pregnancy of a child with a handicap. The latter options – selecting existing human life – poses ethical questions which we will come back to below. However, in all these cases the aim is not to improve or enhance humans beyond what falls more or less within the range of our 'natural' capacities.

All these examples illustrate the history of humankind with its focus on restoration or prevention of deficiencies in human health. This is a crucially different attitude from the intention to improve humans beyond their natural capabilities. The term 'human enhancement' seems to feature in public and ethical discussions rather than in the natural sciences. In our observation, 'human enhancement' hardly occurs in scientific publications – whether in research proposals or in publications on the results of scientific research. No doubt, scientists have an interest in portraying the potential results of their future research in terms of the best possible outcome. In public opinion such aspirations are sometimes mistaken for sound predictions, and 'ambitions of scientists' for 'scientific expectations.' The reality of headlines is sometimes a different one from that of the laboratory.[30] Apart from financial and communicative factors there is, to finish, the fact that anyone, even the most renowned scientist, has only limited knowledge about what the future holds. Just like those of politicians, economists and bank managers, the expectations of scientists may also to some extent be subject to error and be blurred by personal hopes and fantasies, some of which may be more realistic than others.

3.5. Human Enhancement: Ethics and Theology

The 'Human Fault'

How do we ethically and theologically evaluate human enhancement and these converging technologies? We start with a topic to which any theology must pay attention: the reality and tragedy of human failure. The building of the tower of Babel is an ancient paradigm of humans trying to deal with the *condition humaine*. Genesis 11 describes the aspiration of humans to build a tower that reaches into the heavens: "Then they said, come, let us build ourselves a city, with a tower that reaches to the heavens, so that we may make a name for ourselves; otherwise we will be scattered over the face of the whole earth. […]" We all know the outcome. Humanity's unity is destroyed and their worst fear comes true as they become scattered over the face of the earth. In the narrative, there is

an implicit criticism of the human aspirations: "But the LORD *came down* to see the city and the tower the people were building".[31] The tower had already reached a considerable height. Humans believed they were close to reaching the heavens. The text, however, soberly remarks that God still had to come down. The striking element of this story is not the height of the tower. The narrative is not about the construction of a skyscraper. It is about the mistaken ambitions of the ancient Babylonians that they could reach into the skies. It is about humans who wanted to 'make a name for themselves'; afraid of being without relevance, afraid of getting lost.

In a similar fashion we should ask: what are the questions to which human enhancement intends to provide answers and solutions? What is transhumanism's analysis of the *condition humaine*? According to the famous American theologian Reinhold Niebuhr, any theology which ignores the human capacity and propensity to do wrong is deficient and unrealistic. The recognition that humans are sinners and need redemption is at the core of Christian beliefs.[32] From this perspective, utopian dreams are unrealistic and dangerous, not because they overestimate the technical possibilities of humankind, but rather because they naively assume that humans will straightforwardly use technology for the benefit of humankind and of the whole creation. Humans, however, are prone to selfishness and sin, and they suffer from conflicting interests, pain, scarcity, tragedy, and finitude. In the Christian tradition, the evils caused by external factors such natural disasters are called 'natural evils,' whereas evils that result from deliberate human choices are called 'moral evils.' The Christian tradition is unanimous that moral evil constitutes the deepest problem for humankind.

It is a sad truth that anything that exists will at some point be object of abuse. This includes things that in themselves are not morally wrong and may even be intrinsically good – knives, fire, computers, nuclear energy, anesthetics, governmental power – even love. According to St. Augustine, however, nothing that exists in the world can intrinsically, i.e. in itself, be bad. Something only becomes wrong when it is used for pursuing the wrong objectives. The more complex and highly developed something is, the more detrimental and evil will it become when used wrongly. This is why *moral* evil is so stunningly evil: the most highly developed creatures we know (humans) use the most highly developed characteristics they have (i.e. their wills and their minds) to pursue wrong things. Or they may pursue good things in the wrong order, e.g. by attributing more value to creatures than to the Creator. Some things should be pursued ('enjoyed,' Latin *frui*) for their own sake. Among those are humans and God. Other things are meant to have instrumental value only and should be 'used' (*uti*) instead of 'enjoyed.' Other things can be partly used and partly enjoyed. 'Sin' means that something which is meant to be enjoyed, such as God and fellow human beings, is instead being used as a means for other purposes. God, for example, is then seen as the guarantor of human prosperity; or fellow human beings are

sacrificed for increasing the happiness of oneself. Sin can also mean the reverse: when things meant to be used instrumentally, such as money or power, are seen as goods to be pursued for their own sake. In both cases, sin is synonymous with what Augustine calls, 'wrongly ordered love'.[33]

In the Biblical account of Genesis 3, the first sin of human beings is described in terms of 'becoming like God'. In the Garden of Eden, humans have all they need in order to flourish and be happy, to live in accordance with their nature and purpose, and to walk with God their creator. Originally, according to this narrative, there is nothing humans should refrain from. Nothing is intrinsically wrong – except this one thing: pursuing godliness and thus breaking the bond of love, trust, and obedience to the one and only who can be called God. The essence of the first sin is the intention of humans to be like God:

> *"The serpent said to the woman, 'You surely will not die! For God knows that in the day you eat from it your eyes will be opened, and you will be like God, knowing good and evil'."* [34]

Transhumanists with their explicit quest that strives for an eternal life with godly powers do in fact commit the very same original sin, they want to become like God. A good life, to them, is realized when humans, through technological means, can exert hegemony over their own destiny. Christians believe that this claim to hegemony flies in the face of everything we know about the limited place of humans in the universe. True fulfillment resides in a blossoming relationship with God and fellow humans.

According to Aleksandr Solzhenitsyn, the divide between good and evil goes through each and every human heart.[35] Human nature is thus highly ambivalent. On the one hand, humans are unique creatures, the only ones that are created 'in the image of God.' Psalm 8 describes them as only 'little lower than God'.[36] Each human being has a priceless value and has an 'almost divine' capacity to do good. At the same time, each human being has an inborn and stunningly forceful propensity to make bad and sinful choices.

Although we dare say that this realistic (some would call it 'pessimistic') view of humans is typically Christian, it is not exclusively so. The atheistic philosopher John Gray, for example, affirms systemic sin in each human being and criticizes an all too optimistic confidence in progress.[37] The philosopher Martin Heidegger correctly distinguishes two kinds of evil: the adverse consequences of human technology and, more importantly, evil in human nature itself:

> *"The threat to mankind comes not only from potentially fatally acting machines and technological apparatus. The real threat has already affected man in his nature."* [38]

Awareness of the risk that new technologies may carry adverse consequences, and of the fact that humans may use (or further develop) them for dubious purposes, is therefore not a specific Christian approach. It is part and parcel of any responsible reflection on new technologies.

Human mandates in creation: promoting well-being and dignity

From this focus on the human fault, we now proceed to a more positive approach. Humans hold a special responsibility in God's creation. This becomes clear from the creation narratives. In Genesis 1:28, God blesses humanity and gives it an assignment: 'God said to them, "Be fruitful, multiply, fill the earth, and subdue it. Have dominion over the fish of the sea, over the birds of the sky, and over every living thing that moves on the earth"'. The Hebrew words used here for 'subdue' and 'have dominion' (כִּבְשֻׁ֔הָ and וּרְד֖וּ, respectively) have in other contexts the meaning of 'bringing into bondage,' 'subdue,' sometimes even 'tread down.' As nature constitutes a challenge to humanity, sometimes even a threat, humans have a cultural assignment to bring it under control and use it to the benefit of themselves and their neighbours. The subsequent chapter of Genesis breathes a more positive view of nature and includes a more explicit cultural commission. In Genesis 2:15 and 18, God assigns humans to 'cultivate and keep' the Garden of Eden. The Hebrew word used for 'cultivating' (לְעָבְדָ֖הּ) is composed of the same root letters from which the words 'servant' and 'slave' are composed. English translations use the term 'serve,' 'work,' 'dress,' or 'farm.' Humans should 'serve' the Garden rather than merely subdue it. The other term used here, 'keeping' (וּלְשָׁמְרָ֖הּ) stems from the root which means 'guarding,' and 'keep watch.'

Weighing the dialectics of these accounts, Christian thinkers through all ages have interpreted these texts as a calling to responsible stewardship, as a demand to take good care of creation. There is clear consensus that the mandate to take dominion and subdue the world should not be interpreted as a license to exploit or manipulate the earth but as a call to 'keep the garden in good shape.' Humans are called not to subjugate in the sense of imposing their autonomous will, changing creation according to their anthropocentric aspirations, but rather to look after creation and responsibly to discover, use and further release its hidden potentials.

In doing this, humans, created in God's image, are co-creators who consider themselves accountable to God and rejoice in the God-given mandates they have in the world. Servanthood, bearing God's image, and the following of Christ *(imitatio Christi)* come together in the term, stewardship.[39] In the light of the human cultural assignment, we can state two criteria for applying converging technologies: (1) do they serve the wellbeing of humans and the creation, and do they refrain from doing harm? and (2), do they respect the dignity of human beings and the integrity of creation?

One of the complexities of linking these theological notions to contemporary ethics is the existence of sharp disagreements on the meaning and content of terms such as harm, wellbeing, dignity and the 'good life.' As Alasdair MacIntyre has argued, there is no longer a shared conception of a common *telos* of human activity.[40] This should, however, not paralyze us. First, we should not lose sight of the consensus that we have about many basic moral notions.[41] Gratifyingly, there is a broad consensus about the unique value and dignity of each human being, irrespective of their physical and mental capacities.[42] The first two articles of the Charter of Fundamental Rights of the European Union are illustrative: "Human dignity is inviolable. It must be respected and protected," and "Everyone has the right to life".[43] The latter says that we should not kill (or harm) humans, the first that we should respect everyone's dignity. The difference between 'not harming' and 'respecting the dignity' may not be evident at first sight; some people may use them synonymously. But to respect someone's dignity relates to a deeper ontological level of that being than 'not inflicting harm.' Imagine health care professionals ridiculing a comatose patient. Even if they do not inflict physical or psychological harm, they act disrespectfully with regard to his dignity. Respecting someone's dignity thus means to honour and accept her as she is, with her specific identity. This respect can be extended beyond persons: we can respect the identity of animals, a species, and the whole creation.

Christian attitude towards converging technologies

Summing up, we assert that a Christian reflection on converging technologies needs to be geared to three points:

(1) Positive reception and gratitude

The history of science and technology is replete with Christians who have stimulated scientific advancements. Many of those who were actively engaged in exploring nature did so in the conviction that they were exploring God's creation. Johann Kepler's words come to mind when he expressed his motivation to "think God's thoughts after Him." Clearly, Christians have every reason to appreciate science and its achievements. At the same time, they have no reason whatsoever to embrace scientistic and overly optimistic expectations. There is no reason why science and technology should be credited with redemptive powers or an aura of infallibility which can in extreme cases fulfill an almost religious function.

There is, we think, much reason to be thankful for the continuing progress made by science and technology. Their achievements should be welcomed as wonderful gifts of God. Not only do they satisfy the curiosity that is typical of humans as exploring and reflective beings that are called to cultivate the earth. They also serve to improve the conditions of human life and to foster God's creation. The achievements of science and technology can be viewed as a Divine gift, a work of the Spirit to prevent and heal sicknesses and

to offer comfort and relief when there is suffering. Some religious people tend to speak about science and technology merely in the sense of being 'allowed', albeit with some reserve, by God.[44] We think this reserve should make place for enthusiasm and gratitude. Science and technology may be celebrated as forms of activity that justify using words as 'civilization' and 'culture.'

(2) Unwarranted expectations and awareness of the adverse side effects
Converging technologies show promising results and more is to be expected. At the same time, expectations should be phrased with proper scepticism. As with any prediction about future developments, there is neither reason for too high expectations, nor reason to consider recent technological developments as leading to the 'end of Homo sapiens.' Both the sky-high expectations of the transhumanists and the doomsday perspectives of other prophets are mistaken. What should be criticized are not the technologies, but the fears and cheers with which they are surrounded.

Furthermore, we have to be aware of possible adverse side effects of human enhancement technologies. These effects range from effects of converging technologies themselves to the possibilities that humans at some point will use them as instruments for oppression and discrimination.

(3) Motivation: stewardship versus 'becoming like God'
Finally, the construction of the tower of Babel and the Biblical story of the first sin illustrate the human ambition to rise higher than is fitting to our creature status. As indicated above, dreams of a 'superhuman' species are not merely unrealistic; fundamentally, they represent the erroneous ambition to be 'like gods.' The development and use of converging technologies is not to be seen as an attempt to set the destiny of humans and the world. The drive to change the essential characteristics of humans rather than restoring their 'normal,' or 'natural' capacities is irreconcilable with our cultural assignment to act as responsible stewards. Such a stewardship means: developing and applying converging technologies for the benefit of humans and the rest of creation. It implies respect for the dignity of humans, for the way humans are created – their gifts, their potential, their limitations – both as individuals, as communities, and as a species.

3.6. Genetic Screening as an Illustration

Let us illustrate how this normative framework may work by referring to prenatal genetic screening as an example. In the fields of genetic diagnosis and genetic modification huge progress has been made in recent decades. Many moral and political questions have arisen: under what conditions would we accept genetic modification of crops, animals, and humans? What is our view on selecting embryos for implantation? What about abortion if

a prenatal test indicates the presence of a mild handicap, such as a cleft lip *(cheiloschisis)* and a cleft palate? What is our view of human cloning?

We propose to take *human dignity* as our normative starting point. Human dignity represents a value which transcends competing values such as economic efficiency and free scientific research. Christians are convinced that *Homo sapiens*, despite its evident biological kinship and evolutionary history, differs fundamentally from other species, because humans were created in God's image. Although Christians believe that the entire creation needs redemption, the primary reason for Christ's incarnation was the fall of humans and their need of redemption. From the early church on, Christians have proclaimed the dignity of each human being. Free or enslaved, male or female, rich or poor, powerful or oppressed, Jew or Gentile, every person was assumed to have an equal and inalienable dignity. From the first centuries, Christians were engaged in taking care of the poor, widows and orphans, deformed people, in fighting infanticide and in improving the position of women.[45] This affirmation of the human dignity has always implied the firm rejection of practices and convictions which were demeaning to humans.

Human dignity is no ivory tower concept and is found in what Tolstoy calls 'real life': everyday life in all its fragility and concreteness. This is a life which, through the awareness of human need, limitations, and mortality, finds its way towards commitment, depth, beauty, virtue, and meaning; not despite, but rather in and through our fragility and bodyliness.[46] The most important question with regard to converging technologies is not whether or not they should be discarded altogether – clearly, they shouldn't. Neither is it a question whether we should be aware of their potential risks – clearly, we should. The crucial question is what these technologies will do to us humans: to our anthropology, our solidarity, our sense of self-esteem, and our respect for the equal dignity of all. Some of the ends and means propagated by transhumanists may indeed pose a threat to this dignity. It remains to be seen whether humanity can ever be genetically 'enhanced.' But even if this were the case, the persons involved would not be more humane, more valuable, or more dignified. To begin with, every human being already has a dignity that is beyond compare.

In the meantime, the focus on human enhancement could work in the opposite direction, yielding a society which may become more *in*humane than it was. Irrespective of the question whether converging technologies will lead to healthier, more good-looking and more intelligent humans, the continuous focus on improving ourselves may induce disregard or contempt for the less talented. The eugenics and the dystopia of *Brave New World* will hopefully never come true. But some of its oppressive mechanisms may. Of course, 'eugenics' is an emotionally charged term, connected as it is to a past of racial selection and genocide.[47] Despite the fact that eugenics in those horrific dimensions does not apply here, the modern vocabulary of 'enhancing' and 'improving' humans

does in fact distinguish between different classes of people. On a small scale, selection already occurs at life's beginning. That this happens in the context of hereditary diseases connected with very severe suffering and a short life expectancy of a child, can be better understood than when the presence of 'mild' handicaps, such as Down syndrome, leads to abortion. In the near future, the number of genetic diseases which can be found during a pregnancy will rapidly go up. Since hardly any of these disorders can be treated, let alone cured, selective abortion may for an increasing number of parents-to-be become the 'default solution' to the presence of a hereditary disease. For clinical geneticists it may also become harder to resist societal pressures to include the testing of other characteristics, such as sex, IQ, predisposition for certain traits of character, etc.[48]

Perhaps the most important objection to this medicalization of human procreation is that children will increasingly become a 'parental project' for whose genetic quality the parents are considered to bear responsibility. The question is how this relates to viewing a child as a result of a loving relationship, and as a Divine gift received in gratitude and, ultimately, how this relates to the dignity of their offspring. Author and editor of *Nature* Oliver Morton sketched the possible 'consumer's attitude' towards having children:

> *A couple goes to a clinic and provides some sperm and some eggs. The clinic turns them into embryos and analyzes the different mixtures of the parents' genes each embryo carries. The parents are given the embryos' genetic profiles and advice on how the genes relate to various traits, both physical and mental, in various different conditions. At present, such a profile would be expensive and crude, capable of spotting genes for serious genetic disabilities but not much more. But with better DNA-analysis tools and much more knowledge about which genes do what – both fields that are growing exponentially – the pictures will get sharper and sharper. The parents choose the profile they like, on whatever criteria appeal to them; the chosen embryo is grown a bit further in the test tube, a few cells are snipped out to provide tissue for repairs in later life, and then the pregnancy gets under way.*[49]

Again, apart from the factual question whether or not we will at some point be technically able to design our own offspring and improve its genetic quality, we need to ask whether we truly want to pursue these techniques. Suppose that we can be sure that future developments will be well-monitored and controlled, and suppose that we can be reasonably certain that no major side-effects will occur. Even in that case, we may still ask ourselves: do we, as humans and as religious persons, wish to carry this kind of responsibility? Of course, humans have taken all kinds of measures in the past to take influence on their offspring: choosing a suitable partner, contraception, IVF, etc. Still, to what extent is it acceptable that children materialize the dreams of would-be parents? What will be the consequences for intergenerational relationships, for the self-understanding

of children, and for the respect of children for their parents? Would 'designer babies' not in the end represent a refusal to accept new life 'as it comes'? Although it is hard to draw the exact lines, being a creature means that there are things humans should not pursue, because they are creatures, not the Creator – humans, not God.

3.7. Living a Human Life

Health is a top priority of citizens in industrialized countries. We long for a good, preferably long, life. Not all of us may want to live eternally; but many of us would like to live longer, with a body that is as youngish as possible. We want to improve our lives and the conditions surrounding it and have every reason to do so: even in highly developed countries with advanced health care systems, life continues to be burdened with suffering, tragedy, and discomfort. Progress and prosperity are fragile and under continuous threat. The cultural mandate of humankind has lost nothing of its urgency.

Nevertheless, we should also ask ourselves whether the quest for human enhancement addresses the most pressing problems of humanity, and whether technologies will be able to provide effective solutions. Humankind's basic problem does not consist in our bodily or mental limitations but is, so we think, at bottom moral and spiritual. Yes, technologies do improve the quality of our lives. However, the bittersweet truth is that it is in fact suffering, scarcity, limitations, and tragedy – in short: the *condition humaine* – that sometimes lead to our deepest flourishing. Occasionally human values are realized despite the presence of suffering; on other occasions, the realization of these values even seems to need a certain amount of adversity: love, patience, self-denial, heroism, discipline, piety.

This is wonderfully illustrated in *Brave New World,* where Huxley describes the conversation between Mustapha Mond, one of the administrators of the new world, and a so-called savage. The latter represents the few remaining natural humans who have not been psychologically modified, do not use *soma*-drugs, and who live in a reserve:

> *The savage said, "But God's the reason for everything noble and fine and heroic. If you had a God."*
> *"My dear young friend," said Mustapha Mond, "civilization has absolutely no need of nobility or heroism. These things are symptoms of political inefficiency. In a properly organized society like ours, nobody has any opportunities for being noble or heroic. Conditions have got to be thoroughly unstable before the occasion can arise. Where there are wars, where there are divided allegiances, where there are temptations to be resisted, objects of love to be fought for or defended – there, obviously, nobility and heroism have some sense. But there aren't any wars nowadays. The greatest care is taken to prevent you from loving any one too much. There's no such thing as a divided allegiance; you're so conditioned that*

you can't help doing what you ought to do. And what you ought to do is on the whole so pleasant, so many of the natural impulses are allowed free play, that there really aren't any temptations to resist. And if ever, by some unlucky chance, anything unpleasant should somehow happen, why, there's always soma to give you a holiday from the facts. And there's always soma to calm your anger, to reconcile you to your enemies, to make you patient and long-suffering. In the past you could only accomplish these things by making a great effort and after years of hard moral training. Now, you swallow two or three half-gram tablets, and there you are. Anybody can be virtuous now. You can carry at least half your morality about in a bottle. Christianity without tears – that's what soma is."
[The savage protests:] "But the tears are necessary […] You just abolish the slings and arrows. It's too easy."
"We don't," said the Controller. "We prefer to do things comfortably."
"But I don't want comfort. I want God, I want poetry, I want real danger, I want freedom, I want goodness. I want sin."
"In fact," said Mustapha Mond, "you're claiming the right to be unhappy."
"All right then," said the Savage defiantly, "I'm claiming the right to be unhappy. Not to mention the right to grow old and ugly and impotent; the right to have syphilis and cancer; the right to have too little to eat; the right to be lousy; the right to live in constant apprehension of what may happen tomorrow; the right to catch typhoid; the right to be tortured by unspeakable pains of every kind." There was a long silence.
"I claim them all," said the Savage at last. [50]

This fragment sketches an interesting contrast. On the one hand we recognize the idealistic view of the administrator of *Brave New World* who opts for a fully controlled society in which human needs and interests have been satisfied at the expense of true humanity. On the other hand there is the passionate longing of the savage for authenticity and true virtue. Most people will feel sympathy for the latter's rather intuitive longing. However, as Mustapha Mond observes, all these qualities come in one package with the discomforts of ageing, illness, starvation, fear, and pain. In a world that is broken as a consequence of human sin, the one cannot be reached without the other.

We may develop all kinds of techniques to make life swifter, healthier, longer, and more pleasant. It is understandable that some want to call that 'human enhancement.' We agree with regard to the point that science and technology have a continuous responsibility to improve the circumstances in which humans live, to find treatments for diseases, and to prevent suffering. If this is what is meant by 'human enhancement,' this chapter is a passionate plea in favour of it. True human enhancement, however, can only occur at the level of moral virtue and a pious relationship with the living God.

[1] Parts of this paper were published previously as Cees Dekker, "Naar een Brave New World?" in: Cees Dekker, René van Woudenberg, and Gijsbert van den Brink (eds.), *Omhoog kijken in platland. Over geloven in de wetenschap,* Kampen: Ten Have, 2007.

[2] Michael Anissimov, "Brilliant minds forecast the next 50 years," in: *New Scientist* 2578 (18/11/2006), http://www.acceleratingfuture.com/michael/blog/2006/11/newscientistcom-brilliant-minds-forecast-the-next-50-years.

[3] The quotations stem from R. Gosden, E. Heber-Katz, J. Halpern, C. Koch, F. Gage, P. Zimbardo, R. Kurzweil, and E. Loftus, respectively.
See http://www.brainbasedbusiness.com/2006/12/85_brainy_people_predict_the_n_1.html

[4] Aldous Huxley, *Brave New World,* New York: HarperCollins, 1932.

[5] See the preface written by Huxley in the 1947 edition of *Brave New World.* Cf. Aldous Huxley, *Brave New World Revisited,* New York: HarperCollins, 1958.

[6] Cf. J.H. Koeman, C. Dekker *et al., Hoe groot kan klein zijn? Enkele kanttekeningen bij onderzoek op nanometerschaal en mogelijke gevolgen van nanotechnologie.* Report of the Royal Dutch Academy of Sciences, Amsterdam: KNAW, 2004.

[7] Http://www.entnet.org/HealthInformation/cochlearImplants.cfm. Last visited on April 1, 2013.

[8] M.S. Humayun et al., "Pattern Electrical Stimulation of the Human Retina," in: *Vision Research* 39 (1999) pp. 2569-76; M. Javaheri *et al.,* "Retinal Prostheses for the Blind," in: *Annals Academy of Medicine Singapore* 35 (2006), pp. 137-44.

[9] Http://en.wikipedia.org/wiki/Retinal_implant. Last visited on April 1, 2013.

[10] R.H. Hochberg *et al.,* "Neuronal Ensemble Control of Prosthetic Devices by a Human with Tetraplegia," in: *Nature* 442 (2006), pp. 164-71.

[11] S.K. Talwar *et al.*, "Behavioural Neuroscience. Rat Navigation Guided by Remote Control," in: *Nature* 417 (2002), pp. 27-38.

[12] Cf. Cees Dekker, "De moleculaire nanotechnologie van het leven," in: Cees Dekker, Ronald Meester and René van Woudenberg (eds.), *Schitterend ongeluk of sporen of ontwerp?* Baarn: Ten Have, 2005, pp. 117-33.

[13] Cf. Huub de Vriend, *Constructing Life: Early Social Reflections on the Emerging Field of Synthetic Biology,* Rathenau Instituut Werkdocument 97, Den Haag: Rathenau Instituut, 2006.

[14] D. Endy, "Foundations for Engineering Biology," in: *Nature* 438 (2005), pp. 449-53; D. Endy and R. Brent, "Modelling Cellular Behavior," in: *Nature* 409 (2001), pp. 391-5.

[15] Http://www.nature.com/news/brain-simulation-and-graphene-projects-win-billion-euro-competition-1.12291

[16] Http://tudelft.nl/en/current/latest-news/article/detail/investering-van-51-miljoen-euro-voor-nanowetenschap-in-delft-en-leiden. Last visited on April 1, 2013.

[17] For a range of Jewish and Christian views, cf. Leon R. Kass, *Life, Liberty, and the Defense of Dignity: The Challenge for Bioethics,* San Francisco: Encounter Books, 2002; C.W. Colson and Nigel de M.S. Cameron, *Human Dignity in the Biotech Century,* Downers Grove: InterVarsity Press, 2004; N. Postman, Technopoly, New York: Vintage Books, 1993; W.J. Smith, *A Consumers Guide to Brave New World,* San Francisco: Encounter Books, 2004; J. J. Walter and T.A. Shannon, Contemporary Issues in *Bioethics: A Catholic Perspective*, Lanham: Rowman & Littlefield, 2005.

[18] M.C. Roco and W.S. Bainbridge (eds.), *Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Science* and Cognitive Science, Arlington: NSF/DOC, 2002.

[19] Cf. N. Bostrom, "A History of Transhumanist Thought," in: *Journal of Evolution and Technology* 14 (2005); R. Kurzweil, *The Age of Intelligent Machines,* Cambridge, Mass.: MIT Press, 1990; R. Kurzweil, *The Singularity Is Near: When Humans Transcend Biology,* New York: Viking, 2005.

[20] W.N. Joy, "Why the Future Does Not Need Us," in: *Wired* 8.04 (2000).

[21] Martin Rees, *Our Final Century: Will the Human Race Survive the Twenty-first Century?* London: William Heinemann, 2003.
[22] Francis Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution,* New York: Farrar, Straus and Giroux, 2002. Cf. http://en.wikipedia.org/wiki/Our_Posthuman_Future.
[23] C.S. Lewis, *The Abolition of Man*, Oxford: Oxford University Press, 1943. For a more recent discussion on the theme, cf. P. Kreeft, *C.S. Lewis for the Third Millennium,* San Francisco: Ignatius Press, 1994.
[24] Leon Kass quoted in W.J. Smith, *A Consumers Guide to Brave New World,* San Francisco: Encounter Books, 2004, p. xi.
[25] STOA workshop, Converging Technologies in the 21st Century. Heaven, Hell, or Down to Earth? 27/6/2006, Brussels: European Parliament. This title was inspired by the book of J. Garreau, *Radical Evolution,* New York: Broadway Books, 2005.
[26] http://csc.ceceurope.org/fileadmin/filer/csc/Ethics_Biotechnology/Human_Enhancement_March_10.pdf , 7.
[27] Http://en.wikipedia.org/wiki/Human_enhancement.
[28] What may well have been changed recently is the percentage of children born with hereditary diseases. But that does not address the question whether the range of what 'healthy' humans, as humans, are able to perform, has changed correspondingly.
[29] Cf. Cees Dekker, "Uit wat ik ben en was," in: Cees Dekker (ed.), *Geleerd en Gelovig. 22 wetenschappers over hun leven, werk en God,* Utrecht: Ten Have, 2008, pp. 316-36.
[30] From the late 1990s on, stem cell research with human embryos in combination with nuclear transfer ('cloning') was presented as a potential treatment, if not cure, for degenerative, age-related diseases: Alzheimer's, Parkinson's, diabetes. Not only has the development of these applications proven to be harder than expected, but also have we seen a shift of the public debate away from pursuing the development of life-prolonging technology towards the acceptance, and even welcoming, of a not-too-late natural death.
[31] Gen. 11: 4-5, *NASB. Italics ours.*
[32] Reinhold Niebuhr, *An Interpretation of Christian Ethics,* San Francisco: Harper 1963.
[33] Cf. John Philip Wogaman, *Christian Ethics: A Historical Introduction,* 2nd edition, Louisville: Westminster John Knox Press, 2011, pp. 53ff.; Gerrit de Kruijf, *Ethiek onderweg. Acht adviezen,* Zoetermeer: Meinema, 2008, p. 75.
[34] Gen. 3:4.
[35] A. Solzhenitsyn, *The Gulag Archipelago,* New York: Harper & Row, 1973, p. 168.
[36] Psalm 8:5, NASB.
[37] John Gray, *Heresies, Against Progress and Other Illusions,* Londen: Granta Publications, 2004.
[38] Martin Heidegger, *Basic Writings,* New York: Harper & Row 1957, p. 399.
[39] Cf. Theo A. Boer, (ed.), *Schepper naast God? Theologie, bio-ethics and pluralisme. Essays aangeboden aan Egbert Schroten,* Assen: Van Gorcum, 2004.
[40] Alasdair MacIntyre, *After Virtue,* 2nd ed., Notre Dame: University of Notre Dame Press, 1984.
[41] John Rawls speaks here of 'overlapping consensus.' John Rawls, *A Theory of Justice,* Cambridge, Massachusetts: Harvard University Press, 1971.
[42] Cf. Fukuyama, *Our Posthuman Future.*
[43] *Charter on Fundamental Rights of the European Union*, op 7/12/2000, signed by the Member States, and ratified by the European Parliament, the Council of Europe, and the European Commission. http://www.europarl.europa.eu/charter/pdf/text_en.pdf
[44] Cf. Reinhold Niebuhr's depiction of the attitude of some Christians to culture ("Christ against Culture") in Reinhold Niebuhr, *Christ and Culture*, San Francisco: Harper 1951.

[45] For an overview of the positive role of Christianity in culture, cf. Alvin J. Schmidt, *Under the Influence,* Grand Rapids: Zondervan, 2001; Rodney Stark, *The Victory of Reason*, New York: Random House, 2005; Theo Boer and Stef Groenewoud, *Vroegchristelijke denkers en hedendaagse morele zorgdilemma's,* Den Haag: ZonMW, 2011.

[46] Kass, *Life, Liberty, and the Defense of Dignity,* p. 18.

[47] Practices and ideas from eugenics were not confined to Nazi-Germany. Before World War II, eugenics was as popular in scientific circles in the United States as it was in Germany. See, for example, Ian Dowbiggin, *A Merciful End. The Euthanasia Movement in Modern America,* New York: Oxford University Press, 2007.

[48] We should be aware of the many technical hindrances. The fact that the human genome has been mapped, does not in any way mean that we know how a certain genetic profile is connected to, say, intelligence. A simple one gene-one trait picture is definitely incorrect. Much future research is needed to establish the complex relation between genetic profile and traits.

[49] Oliver Morton, "Overcoming Yuk," in: *Wired* 6.01 (1998). Http://www.wired.com/wired/archive/6.01/morton.html (last visited January, 2013)

[50] Huxley, *Brave New World,* chapter 17.